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Men and Arms in the Middle East: The Human Factor in Military Modernization

Anthony Pascal, Michael Kennedy and Steven Rosen

with Paul Jabber, Margaret Krahenbuhl, Joseph Large, David Ronfeldt

A Report prepared for

DIRECTOR OF NET ASSESSMENT,
OFFICE OF THE SECRETARY OF DEFENSE

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PREFACE

This report addresses the contributions of manpower quality and managerial competence to the effectiveness of military forces in the Middle East. In this region the human factor plays a critical role in explaining variations in military effectiveness. The report uses a conceptual framework for analyzing human contributions and presents factual information organized to illuminate trends and improve assessments of the military balance. The report, which was written before the recent upheavals in Iran, relies in part on official documentation not readily available.

Research focused on the Arab states in their confrontation with Israel. The study included explorations of military modernization in Iran and Turkey both because these states appeared to be potential military exemplars for their Arab neighbors and because they figure in other important regional balances. Under the terms of the agreement with the sponsor, no explicit investigation of Israeli military developments was undertaken. This research was sponsored by the Director of Net Assessment, Office of the Secretary of Defense, with funds provided by the Defense Security Assistance Agency.

SUMMARY

This study assesses the contributions of improvements in the quality of manpower and organization to the military effectiveness of certain Arab states—Egypt, Syria, Jordan, Saudi Arabia and Iraq—plus Iran and Turkey. Military development in the first group directly affects the future of the Arab-Israeli balance, and the last two are interesting both because they may be modernization exemplars for their Arab neighbors and because they figure in other critical Middle East balances. Historically, the Israeli advantage has stemmed from its superiority in manpower and management. It has proven itself more advanced than its adversaries in both micro-competence—the operation and support of modern weapons—and macro-competence—the organization of men and weapons in the pursuit of military objectives. The project reported on here was motivated by several factors:

- The apparent improvement of Arab forces relative to Israeli forces in 1973 may have signaled a gradual convergence in competence between the two sides.
- The new weapons being introduced into the region have implications for the importance of micro-competence and macro-competence that differ from the past.
- Paths to military modernization adopted in non-Arab neighbor states in the Middle East may have influenced Arab military policies.

This study made no attempt to directly assess progress in the Israeli military establishment.

DATA SOURCES

For each state we examine current and future supplies of talent available to the military and social and cultural trends that influence the supply. These ultimately determine the capability of military forces to exploit advanced weapons. Data sources on general modernization trends included published statistical compendia on economic and social conditions, the growth forecasts developed in a companion study, and interviews with people in government and private firms familiar with the Middle East scene. We also queried staff at American universities about Arab students studying in the United States.

We investigated Arab performance in the 1973 War to gain understanding of how human capital and organization factors work themselves out on the battlefield. Open and classified literature was consulted.

For countries that operate weapon systems originating in the United States, we examined the current absorption process in some detail, concentrating on skill and organizational factors that may impede wartime performance now and in the future. Deriving conclusions as to rates of progress necessitated investigation of force assembly, training, practice, and management. Data consisted of interviews with knowledgeable military and contractor officials, intelligence reports filed by observers, and formal studies prepared in DoD and elsewhere.

CONCEPTUAL APPROACH

After reviewing various arguments about the relation between broader socio-economic modernization and modernization in the military, we concluded that an effective fighting force, capable of engaging a sophisticated adversary, is most likely to emerge out of a developing society. Only then will the skills and outlooks necessary to successfully prosecute a modern war be available. We considered, but ultimately rejected, the alternative model, which posits the building of a sophisticated military capability in isolation from, or even as a precursor to, general development.

To better understand how modernization in the civil and military sectors interrelate we developed a conceptual scheme. Figure S.1 presents a flow chart that depicts this approach. It is most convenient to begin at the bottom. The *military effectiveness* (M) of any military branch is determined by three factors: the *military situation* (K) facing the country, the particular *weapons* (L) it possesses, and the *effectiveness of utilization* (J) of these weapons. Utilization effectiveness is determined by the country's *military human capital resources* (I), which are broken into the *human capital skills* (I-1) and *managerial-organizational forms* (I-2) that are available. The level of human capital skills and the effectiveness of organizational forms will be determined by *on-the-job training* and *unit practice characteristics* (H), *training programs* (G), and the *raw material* (F) available to the military sector. The role of *foreign assistance* (N) looms large here, in assisting training and exercise programs, as well as directly augmenting operational domestic personnel. The human raw material, or manpower quality (F), available to the military depends on three factors: the *attractiveness of the military* (including powers to conscript) (D), *alternative opportunities* in the *civilian sector* (E), and the *national human resource base* (C). The last is more fundamentally shaped by *civilian human capital programs* (B) and the characteristics of the underlying *population base* (A).

GENERAL MODERNIZATION TRENDS

Saudi Arabia leads in the region in economic growth, followed by Iraq. The others, particularly Egypt, will experience much less growth. For general indicators of modernization (e.g., literacy, urbanization, female labor force participation) the rankings are reversed, with Egypt in the lead and Saudi Arabia only at the take-off point. Turkey shows up well, and Iran was fast catching up before the recent upheaval. Educational attainment is highest in Egypt, Jordan, and Turkey, the states with the most exposure to the West; but the oil exporters are beginning to devote considerable resources to scientific education and study abroad. The Arab states are intricately linked by flows of capital from the oil-rich to the oil-poor and a flow of expatriate labor in the opposite direction. Middle Eastern students enrolled in the United States are increasingly shifting to technical subjects, and increasingly large fractions of them originate in the oil countries. Undeveloped mechanical aptitudes and motivation problems often impede their progress. Students from Egypt, Jordan, and Syria are higher caliber, but many do not return to their home countries. Egypt has the most impressive existing science and technology base, alhough Iraq and Saudi Arabia have ambitious plans. Shortage of physi-

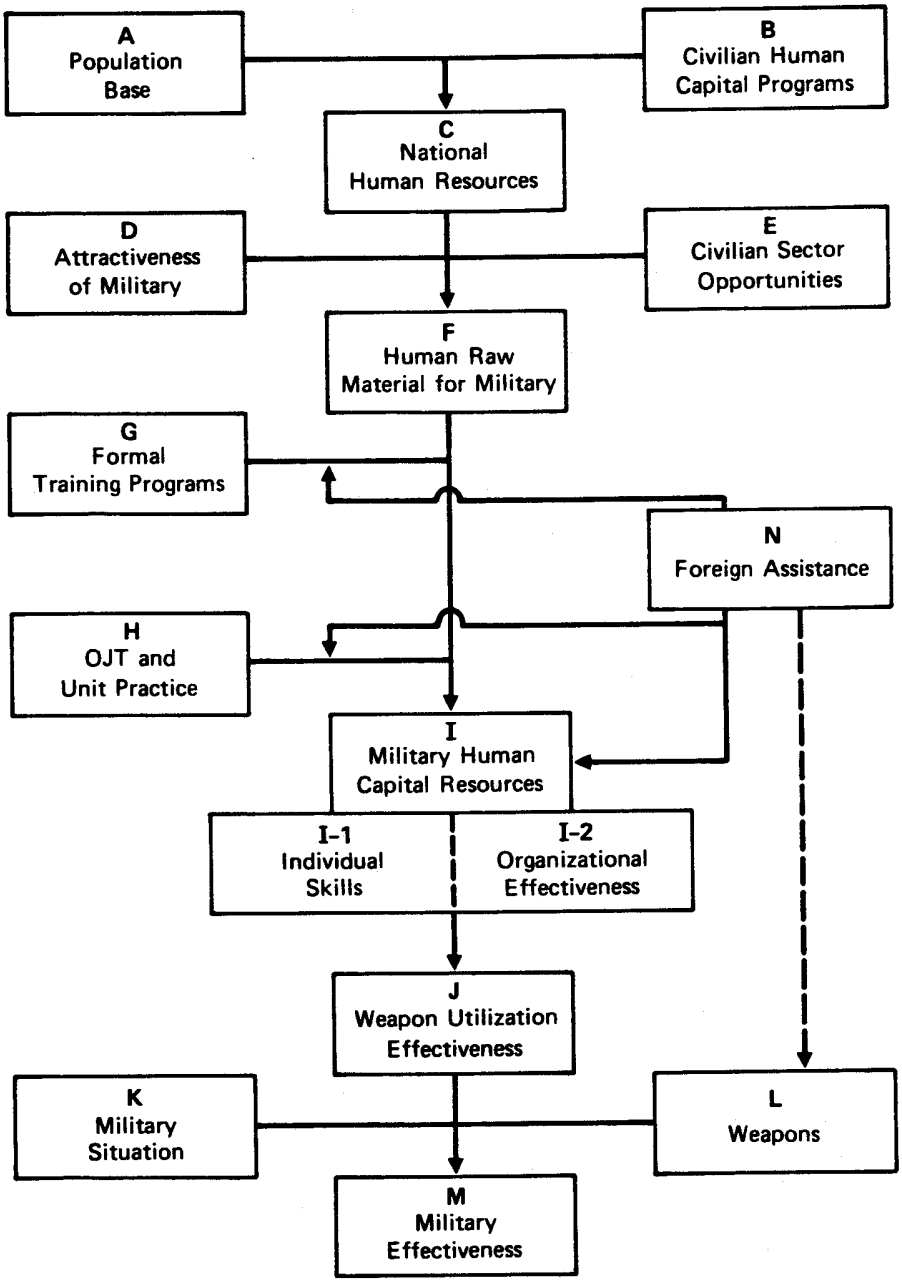

Fig. S.1 — Conceptual flow-chart: the role of human capital in military effectiveness

cal facilities and the paucity of middle level technicians constitute the most serious problems throughout the region.

Development changes outlooks and attitudes, but not fast enough to prevent cultural factors (and political insecurity) from exerting a drag on modernization. Authoritarian behavior patterns, traditional education methods, and the concern for "face" and "clean" occupations all inhibit delegation of authority and innovative, problem-solving styles.

THE DETERMINANTS OF MILITARY EFFECTIVENESS

We conclude that the human factor does indeed play a critical role in the development of military effectiveness. We examined the current situation with respect to the mental and physical characteristics of troops, the qualities of leadership in officers and military management structures, and prospects for change.

The oil-rich and confrontation states devote the largest share of national resources to military ends. Other things equal, populous states have an advantage in assembling trainable forces, although civilian human capital programs help. Industrialization, urbanization, and exposure to the West seem to confer definite advantages; but rapid rates of economic growth severely constrain military recruitment and retention. Regime instability generates significant costs: It inhibits delegation of authority, increases the propensity to assign and promote the loyal rather than the competent, and discourages realistic practice and exercise. Modernization weakens certain cultural predispositions—the disdain for manual labor, the preference for rigid hierarchy, the fear of innovation, the tendency to punish risk-takers —that adversely affect military performance. But men change more rapidly than institutions; the development of organizational structures featuring delegation of authority, rationalized information flows, and incentives for proper performance seems to lag.

Recruitment standards and retention policies obviously affect the quality of the force, but they are constrained by mobilization needs and broader social ends. Appropriate assignment of personnel to function is only beginning to receive attention. The tendency to assign the best people to the newest and most prestigious units, the disinclination to demote the incompetent, and the reluctance to tap civilian expertise reduce capabilities. Class barriers to participation are generally falling, but sex barriers remain strong in most states.

Training receives serious attention in all the states but is hampered by shortages of skilled instructors and motivation problems among trainees. For many functions it takes twice as long to train a Middle Easterner as would be necessary for an American. Generally, it is easier to train operators than maintenance specialists. The use of expatriate personnel as instructors expedites training, but their employment in key support roles detracts from the potential autonomy of the force in wartime. For maintaining skill levels and flexible response capabilities, realistic practice and exercise sessions are required but seem difficult to institutionalize in the Middle East. The attempt to substitute capital for labor through "black box" remove-and-replace approaches may simply escalate skill demands to higher levels. Supply systems provide illustrations of organizations in which traditional patterns of authority and responsibility constrain efficient performance. In the states for

which authentic wartime tests of general command and control capabilities are available, weaknesses have repeatedly been noted, although there have been some signs of progress.

NET ASSESSMENT

As to the Arab-Israeli balance, we argue that although individual competence—skills, stamina, motivation—is rapidly improving on the Arab side, and may even be improving relative to that of the Israelis, the advancing technology of warfare has ambiguous implications for the *importance* of competence to military outcomes, particularly if we assume that surprise in initiation of hostilities is no longer likely.

The proliferation of untried weapons, molecularization of the battlefield, and other developments will probably escalate competence requirements at the macro level—in the organizational and managerial qualities affecting performance of fighting units. And it is precisely at the macro level where no significant closing of the Arab-Israeli gap is perceptible. (The Arabs, however, may conclude that the undoubted improvements they have made do lead to a reduction in net disparities. This could push them to favor the war option.) Therefore, it is unlikely that there will be a revolution in net effectiveness against Israel over the next ten years.

With regard to other balances in the region, differences in comparative rates of modernization may be more significant. Iran, for example, appeared before the recent upheaval to be gaining in military effectiveness relative to its Arab neighbors as a result of the prodigious efforts that were underway there.

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Many observers of the Middle East scene outside of Rand and OSD/NA generously agreed to be interviewed. Promises of confidentiality preclude our mentioning names and affiliations, but they include personnel in the Departments of Defense, State, and the Treasury as well as in the Central Intelligence Agency and the National Science Foundation. The authors also benefited greatly from discussions with officials in American firms, universities, and organizations that have important ties to the Middle East.

To all of these people go our thanks and our apologies for any errors and misinterpretations the report may still contain.

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I. INTRODUCTION

OBJECTIVES

The outcome of any particular war depends on a host of factors including the degree of surprise attained by the initiator, the availability of troops and weapons, the skill of leaders, and fortuitous events on the battlefield and in world chanceries. In the Arab-Israeli confrontation especially, the qualities of officers and men weigh heavily in the balance. Wars there erupt suddenly and terminate quickly because strategic objectives are limited. Both sides own weapons of extreme sophistication. In these circumstances high levels of technical and military competence, adaptability in the face of uncertainty, and ability to exploit unforeseen opportunities count for much.

Historically, the Israelis have displayed a decided advantage in just such fields. Israel has fielded a citizen army composed of solidly educated, technologically advanced, and highly motivated soldiers who fight in well-integrated military components. Their Arab adversaries, however, have assembled forces composed of modestly trained conscripts, rigidly organized into rather isolated units. Yet the Arabs, particularly in the latest confrontation, show signs of learning from their own past mistakes and from the successes of their opponents. Many of the Arab societies have enjoyed considerable economic growth and have experienced the sort of social change that adds to military potential. With an overwhelming advantage in numbers and with a clear advantage in weapon inventories, a significant improvement for the Arabs in human capital would suggest the eventual disappearance of the Israeli military edge.

This study concentrates on the contribution of advances in human capital and organization to the military effectiveness of Middle East forces. How real has been the improvement in human and managerial elements—what we call for convenience, military modernization—on the Arab side? Has it been rapid enough in relative terms to portend the erosion of Israel's military superiority? Which of the Arab militaries has registered the most impressive pace? What background factors explain trends in military modernization? What lessons have the Arabs learned or might they absorb in the future from the course of military development in the neighboring Muslim nations, Iran and Turkey? Finally, given forecasts derivable from observable events, what result might we expect from future wars in the region? Such questions have motivated the present study.

This report attempts to trace the recent history of military modernization, in its human and managerial dimensions, in the chief Arab states and in Turkey and Iran and to draw conclusions about future prospects. The remainder of this section discusses the relationship between general and military modernization and our research methodology. Section II offers a conceptual framework designed to illustrate more systematically the interactions of general development trends and specific military policy decisions as determinants of the rate of change in military competence. In Sec. III we present data on the course of development in the economic, technological, and social spheres in the Muslim states of the Middle East, particularly for Egypt, Syria, Saudi Arabia, Jordan, and Iraq. Section IV summa-

rizes our attempt to validate our hypotheses as to the correlates of military modernization; and Sec. V provides a preliminary assessment of the military future of the region and points out important remaining research questions.

THE RELATIONSHIP BETWEEN MODERNIZATION AND MILITARY EFFECTIVENESS

Although there are various doctrines concerning the relationship between a nation's stage of development and its military effectiveness, a search of the literature reveals a plethora of speculation and a paucity of theory.[1] The state of knowledge is still so primitive that empirically testable hypotheses are nonexistent. Nevertheless, the arguments can be classified into two basic types: One holds that development generally precedes the attainment of an effective fighting force, and the contrasting view holds that military effectiveness not only leads but that, in fact, the stability it provides is a prerequisite to development.

In the first view, change in a society is seen to proceed simultaneously on several fronts. The attainment of internal political stability is often the prerequisite because leaders can then concentrate attention on issues other than their own survival. Furthermore, without some measure of stability, other elements of society find it difficult to engage in planning that requires a degree of predictability as to the course of future events. Given control over expansion of consumption, economic growth may provide the surplus of resources that may be devoted to investments in physical and human capital and in more effective organizational forms.

Modernization brings about the changes in attitudes toward work, innovation, science, the future, personal initiative, and other matters that reinforce further development. A belief in this series of linked and mutually reinforcing streams of progress constitutes one explanation of how a country develops itself sufficiently so that it can, if it chooses, become an effective military power.

As societies develop and change they become more adept at absorbing, adapting, and exploiting the advanced technologies embedded in contemporary weapons. When one's adversary is a modern industrial state with a highly skilled and motivated army, the failure to field a force of well-led, technically able men often has meant failure on the battlefield. Economic and social development, considered in the broad, generates many of the qualities necessary for such a force. Social and cultural attitudes alter with development and become more compatible with the management practices modern warfare demands. Mechanical aptitudes evolve among the populace so that troops can be trained to operate and support advanced military hardware. Thus, modernization, in general, seems to underlie the emergence of modern military forces. This line of thought forms our basic approach.

But a converse relationship merits consideration. The military, after all, competes with the private sector and with the civilian bureaucracy for technical expertise and managerial competence. Rapid rates of growth in civilian sector opportunities may drain away the talent upon which a modern force must depend. And, clearly, the military also competes for physical resources, domestic and imported, as well as for the sustained attention of the nation's leaders. Political energy and

[1] See, for example, Klaus Knorr, *Military Power and Potential*, D. C. Heath, Lexington, Mass., 1970 (especially Ch. 2 and pp. 92–97) for reviews of relevant literature and synthesis of current knowledge.

commitment are always in short supply. Particularly in countries with a heritage of Levantine bureaucracy, the priorities pursued by the governing regime will affect the rates of development among the various sectors.

Advocates of the second type of doctrine argue that military power, in all but the most primitive states, may emerge not out of general socioeconomic and cultural change but out of a deliberate decision by a committed leadership to develop this sort of prowess as a basis for national development *or* as a way of maintaining its own power. A further distinction is necessary. The leadership may recognize that a modern military will stimulate general modernization and thus attempt to design a force that will enhance such side benefits. Alternatively, leaders may actually prefer a modern army in an otherwise traditional society and thus work to improve but also to isolate the military. Ataturk's efforts in Turkey and King Abdullah's with the Arab Legion tend to illustrate the two approaches. Although it can be granted that a modern military force requires healthy, literate, motivated, and technologically competent personnel with organizational ability and a problem-solving orientation, and that economic development produces such qualities in the populace, it nonetheless may prove more efficacious for a country to give second priority to general development in its quest for military effectiveness and instead isolate the military from the rest of society and simply direct to it the required resources.

When highly developed weapons systems and the training necessary for their operation can be imported, the link between the indigenous society and its military sector is further weakened. In fact, general development may even inhibit the initial attainable rate of growth in military capability by diverting resources, destabilizing politics, and channeling energies into private rather than public endeavors. If a modern military force can import weapons and training and can secure the most talented members of society, and if it is accorded and enjoys high prestige, it may exist in an otherwise quite backward society.

The military may then become a source of modernizing pressure on the rest of society through the provision of educated, trained, and motivated people who have completed their military service or through direct civic action (e.g., teaching, public health, infrastructure projects). In any case, this second argument holds that the military leads and precedes and is not primarily the beneficiary of general development elsewhere in society. These considerations led us to a general concern over the degree to which the military is isolated from or integrated into the society. The linkage varies over time and geography.

Of the countries we have studied, some conform more closely to the first model (Egypt is probably the best example) and others adhere more nearly to the second (Saudi Arabia now, and Turkey in the past). But in no case is the fit perfect; in the Arab-Israeli dispute all the participants have accorded high priority to the development of military power and each has also enjoyed a general upward movement in technical and economic capacity that has benefited its military force. Generally then,

- Modern military potential is a function of economic and technological development; both economic and technological development and military performance are dependent on the existence of appropriate values, attitudes, and ways of behavior.

- Although the modernization process in each of the countries under study supports their abilities to wield military power effectively, their large-scale reliance on importation of military technologies, expertise, and training has created a situation of asymmetric development, and there may be a wide gap in the pace and status of modernization between the high-technology military sectors and the rest of society. Therefore, (1) society-wide development indexes do not provide reliable indicators of future medium-term military proficiency; (2) to provide this we need not only a comparative analysis of Arab military performance since 1967 but a more adequate theory of the long run determinants of military power as they emerge from social and economic change.
- In assessing the quality of manpower in the more advanced sectors, we need to develop a means of evaluating the extent to which relevant pro-technological values, once downgraded in traditional Arab culture, are now being absorbed.

We have generally tended to adopt the perspective implying that development precedes and is the basis for military competence. We have indeed focused on the positive aspects of this relationship and have tended to ignore a conceivable negative repercussion—that development and modernization can lead to political instability and thereby reduce ultimate security even though military effectiveness may have improved (namely, the current turmoil in Iran). Thus, by and large, we have assumed that stability is a prerequisite to the attainment of military competence and that development enhances stability.

RESEARCH METHODOLOGY

Selection of Countries

The current international situation, as well as recent history, made a convincing case for including certain states. Egypt and Syria have borne the brunt of the fighting against Israel and their inclusion was automatic. Jordan, as a neighbor of Israel, as a sometime participant in the series of wars, and as a contender for control of the West Bank, also merits detailed attention. Although it has played a modest role from a military standpoint, Saudi Arabia's position as chief financier of the Arab cause, particularly since 1974, makes its inclusion necessary. It may also participate much more significantly in future military engagements. Iraq's growth in oil revenues, its current radical government, and the strong Soviet influence argued for inclusion. It has been less active against Israel than Egypt and Syria in the past but more involved than Saudi Arabia. For convenience, we call these the "primary" states. Several, such as Saudi Arabia and Iraq, have demonstrated significant rates of economic and social development. Others (Egypt, Syria) have shown appreciable progress in military competence. By means of cross-country comparisons we attempt to derive implications about the interrelationships of these trends. Beyond the primaries, we had to make hard decisions on inclusion of countries, partly as a result of research time and resource constraints.

Lebanon's geographic position and the availability of information predisposed us toward its inclusion. But its history of relative neutrality in the confrontation

and its modest military capabilities led toward exclusion. We therefore did not collect data directly on Lebanon.

Although oil revenues continue to accumulate in the smaller Persian Gulf states, given their scant indigenous real resources and remoteness, they are probably more interesting as financiers of military capability in the primary states than as powers in their own right.

Some of the same arguments made with respect to the Gulf States applied to Libya, although recent history suggests an even more active role as a financier of confrontation and as a provocateur of conflict. Our treatment of Libya and the Gulf states is restricted to observations on students enrolled in U.S. universities.

The Mahgreb, Saharan, and Sahel nations seem either too remote from the Middle East conflict or too weak to warrant consideration at this stage. Even those with substantial financial resources, such as Algeria, have internal development needs that make a much more active role in the confrontation unlikely in the near future.

Strong reasons argued for both the inclusion and the exclusion of Iran[2] and Turkey. They are not Arab states and until recently at least did not maintain a hostile posture toward Israel. Iran's presence in the Persian Gulf does affect the military postures of its neighbors, Saudi Arabia and Iraq. Even more interesting about Iran and Turkey, however, are the lessons they promise to teach us about auspicious and inauspicious paths to military development in their Arab neighbors. The efforts Iran had until recently undertaken to attain power status in both the military and economic spheres actually predate the recent massive escalation in its oil revenues. And the course Iran followed—buildup of indigenous education and training facilities, importation of foreign advisors and teachers, investment in high technology industries, procurement of advanced weapon systems with their accompanying technicians—may well be emulated in the primary states, which have, after all, societies not too dissimilar from the Iranian. Recent events in Iran however raise serious questions about the future of the modernization program there and about the extent to which neighboring states will want to emulate its example.

Turkey has a reputation for military prowess demonstrated in actions in Korea and against the Greeks in Cyprus, and its membership in NATO works to raise standards of military performance. Turkey also interests us in its potential role as an exemplar for the Arabs.

In fact, supporting research revealed that Turkey and Iran have *not* played the role of exemplars for the Arabs in any specific fashion. Still, study of these neighbor states, particularly Iran, proved valuable because they had been in some respects further along the road of military modernization the Arabs are also traveling. Thus they have not been conscious mentors but may highlight future problems and opportunities.

Basic Approach

Our objective has been to assess the future ability of the Arab states to manage complex military functions (e.g., combat, logistics, training, communications) and to exploit the modern technologies necessary to effective military operations. The

[2] This report was written before the revolution in Iran that led to the downfall of the Shah's regime.

requisite managerial and technological skills emerge from several sources in civilian society.

To understand this process, we developed a conceptual model designed to illustrate how supplies of talent interact with military sector policies and equipment to produce various degrees of martial prowess, recognizing that the process requires the evolution of appropriate administrative structures. The model helped us identify the key points at which the current state of and future prospects for military effectiveness may be assessed. We used several devices to evaluate the validity of hypotheses derived from the conceptual model.

We gathered extensive data on modernization trends in the selected states. Our intention was to assemble information to assess:

- *The current supply of talent.* The first step involved organizing data on the level and quality of trained manpower for both leadership and technical positions. Quantitative information was garnered, where possible, from published statistics, and on quality from area experts. In many cases, we were unable to arrive at numerical estimates of the sources of supply.
- *Likely future talent supplies.* In the near future, over say the next ten years, the sources of technicians and managers who could be available to the society and its military sector constitute the existing "pipeline." We used information on planned investments in education, in training, and in the national scientific infrastructure to assess the size and quality dimensions of near-future talent pools.
- *Sociocultural trends that influence the supply of talent.* Certain social and cultural aspects of a particular national society influence the effectiveness of manpower and organization available and underlie prospects into a future more distant even than the ten years referred to above. Although demographic trends, for instance, would indicate how many people of appropriate ages will be available for training, we must also gain insight into some of the cultural attitudes that govern a society's ability to devote its human resources to particular uses. In many spheres, traditional predispositions may stand in the way of progress, and it is therefore important to gauge the pace of change in certain relevant attitudes.

The following hypotheses guided us in making this assessment:

- An approach to problem-solving emphasizing rationalism and the scientific method rather than fatalism and convention is likely to result in pressures for more rapid change.
- When prestige attaches to technical occupations rather than to the traditional professions (lay, humanities, religion), change is likely to occur faster.
- The propensity to welcome ideas from abroad, to overcome xenophobic rigidity, will facilitate development.
- The maintenance of barriers to upward occupational mobility against lower status people, women, and foreigners diminishes the talent pool out of which trained personnel may be recruited.
- Reluctance to delegate authority and responsibility by superiors and fearfulness about displaying initiative among subordinates are likely to inhibit organizational effectiveness.

In producing our assessment of general development, we were concerned with both indigenous change and foreign contributions, whether the latter were carried on in the primary state (e.g., training of military technicians and of industrial management counterparts) or abroad (e.g., training in military staff colleges or university schools of engineering). Our primary focus for foreign contributions was the United States, but we recognize the potential importance of training offered by other Western nations, by states in the region itself, and in the Soviet Bloc.

The sources of talent we surveyed include formal schools (secondary schools, universities, and technical institutes, both civil and military); training programs within organizations (for example, courses given by military units, industrial firms, and government agencies); on-the-job training (as in the case of counterpart programs); and the direct importation of both military and civilian labor.

Trained labor and skilled management emerging from these sources can be applied in either military or civilian sectors at different levels or for various functions within each sector. We were interested in mechanisms used to allocate the talent. For the military sector, devices include conscription, volunteer systems, mobilization, military academies, and the hiring of civilians for military tasks. On the civilian side, labor may be "recycled" back into universities and other formal schools and research facilities to produce succeeding generations of managers and technical workers.

Besides the numbers, types, and proficiency of skilled people (micro-competence), a crucial aggregation problem eludes separate numerical tabulation: the competence and effectiveness and integrity of *organizations* or *macro*-competence. Organizational performance clearly rests on the quality and types of staff. But in addition, the performance of an organization depends on how it is structured, internal incentives, informational access, and the like. Evaluating the status and progress in organizational behavior in the selected Middle Eastern societies has been a major task of our information gathering and interviews. Our research has stressed the recruitment and performance of leaders and skilled personnel on the one hand, with institutions and organizational infrastructure on the other.

The identification of key points in the conceptual model also guided our research on weapons systems absorption in a number of states in the region. We believed that a profitable method for assessing military performance lay in examination of specific weapons systems imported by various Middle Eastern countries. We wished to determine how skill and organizational factors have affected weapons use. For example, we inquired into the current and prospective performance of combat air and air defense systems in the recipient countries and the degree to which performance has been affected by problems in operator and maintenance skill levels or supply organization. We subsequently developed prognoses on effectiveness of use over time as skill levels or organizational schemes improve.

For the selected militaries analyzed, we stressed, as examples, the absorption of the F-5 fighter aircraft and the Hawk air defense system. Among the weapons in the Arab inventories, these systems demand high levels of individual or *micro*-competence. They also tend to receive high priority in manpower allocations and, in fact, are typically manned by volunteers rather than conscripts.[3] Thus, we felt

[3] The anti-tank missile units were also favored in assignment and in training resources. Generally, however, the chief Arab forces have used Soviet-supplied anti-tank systems; this fact made data collection on the performance of the Saggers, for example, impossible.

that the F-5 and Hawk experience constituted good tests of absorption potential. The ability to effectively operate modern fighters and SAMs would imply a general ability to exploit contemporary weaponry. As an added inducement, air supremacy has proven a critical determinant of the outcomes of wars in the region.

Ground systems such as armor and artillery, which generally impose less rigorous demands on micro-competence, also rank lower in terms of manpower supply. A full scale analysis, as opposed to the exemplary analysis pursued in this report, would require the simultaneous examination of (1) the quality distribution in the military manpower pool, (2) the skill demands generated by the entire weapons inventories, and (3) the mechanism used to assign and train people for various functions. Because study resources were limited, we concentrated on the air systems.

But relevant military effectiveness requires more than improvements in micro-competence. Organizational factors and higher level management quality influence how well systems are exploited in fighting wars. The ability to successfully position, support, and integrate individual units we call *macro*-competence. And competence is ultimately meaningful only *in relation to the competence of the adversary.* We did attempt to make summary judgments as to progress in Arab macro-competence (and similarly for Iran and Turkey), but we can only speculate on the rate of advance in both types of competence for the Israelis.

Thus our study is concerned both with the current inventory of skills and organization capabilities present in each society and the skills and organizational structures needed for effective utilization of modern weapons systems. But "need" is, of course, too strong a word, because (1) systems can be effectively operated and supported in many circumstances, including those relating to skill availability; and (2) deficiencies in some critical skill or organizational capabilities may degrade the weapon system performance but not necessarily render it "ineffective." We thus examine degrees of performance as they are related to adequacy of skill and organizational base.

In addition, skill level is not a static phenomenon but is constantly changing as a function of training and experience. That effective weapons absorption has a *time profile* means that we had to consider intertemporal tradeoffs in the ability to effectively utilize equipment; for example, heavy reliance on foreign contract personnel may enhance performance now at the cost of a trained, indigenous work force in the future.[4]

For each weapons system of interest, we asked four kinds of questions:

1. What skills and organizational forms are (or would be) used in the United States to operate the system?
2. What are the intentions for operating the system in the specific country? That is, if those in command of carrying out the system *plan* a different mix at skilled and unskilled labor and capital for performing the tasks necessary to operate and maintain the system, what is it? What are the implications for this *planned* mix for the *actual* processes and procedures used in supporting and operating the system given the resources available?

[4] Dependence on foreign personnel for military functions obviously affects the recipient nation's autonomy, as well.

3. How has the weapons system operations and support scheme worked out in practice?
4. What are the implications of 3. for the effectiveness of the system as tested in exercises and maneuvers?

In addition, evidence from the October War of 1973 provided information on the effects of various reforms instituted in the Arab forces between that time and 1967. Studying the successes and failures in Arab performance during the Yom Kippur War allowed us to derive conclusions about which policy revisions seemed to work and which did not.

Data

The data used in the course of this study consist of documents and reports published by the U.S. government, by Middle East governments, and by international agencies and the general literature on the Middle East. Equally important were an extensive series of interviews with U.S. government officials (civil and military), scholars, businessmen, and educators, all in this country.

We combined information from interviews and written sources to derive judgments on the current status of and future prospects for general development in the states of the Middle East. For our analysis of the 1973 War and the period leading up to it, we relied primarily on the open literature—books and articles—written on the subject.

We used three basic data sources for weapons absorption: interviews with people directly knowledgeable about the situation in the country, reports filed by observers on the scene, and formal reports on the particular country issued by various agencies of the U.S. government, particularly the Defense Department. Because we promised confidentiality to all our interviewees, many of the observations are not documented and thus cannot be double-checked. We believe that the resulting candor of our sources more than compensates for the lack of documentation.

II. A CONCEPTUAL FRAMEWORK FOR ANALYZING THE DETERMINANTS OF PROGRESS IN MILITARY EFFECTIVENESS

This section outlines a conceptual framework for analyzing the effectiveness of weapons system utilization. The framework is based largely on our studies of Middle Eastern countries and imported fighter aircraft and surface-to-air-missiles and may suffer from some narrowness of experience in that regard.

Figure 1 is a flow chart that illustrates our proposed framework. It is most convenient to begin at the bottom. The *effectiveness* (M) of any particular (group of) military unit(s) is determined by three factors: the *military situation* (K) facing the country, the particular *weapons* (L) it possesses, and the *effectiveness in utilization* (J) of these weapons. Utilization effectiveness is determined by the *military human capital resources* (I) of the country, which are broken into the *human capital skills* (I-1) and *managerial and organizational forms* (I-2) that are available. The level of human capital skills and the effectiveness of organizational forms will be determined by *on-the-job training* (OJT) and *unit practice characteristics* (H), *training programs* (G), and the *raw material* (F) available to the military sector. The role of *foreign assistance* (N) looms large here in helping with training and exercise programs as well as directly augmenting operational domestic personnel. The human raw material, or manpower quality (F), available to the military depends on three factors: the *status of the military* (D), *civilian sector* (E), and the *national human resource base* (C). The latter is more fundamentally shaped by *civilian human capital programs* (B) and the characteristics of the underlying *population base* (A).

We will now proceed from the top of Fig. 1 down, examining in a more detailed way: (a) how we conceptually define the important variables associated with each box and (b) how we might empirically measure these variables and the nature and magnitude of the causal relations among them.

HUMAN RESOURCES OF THE NATION

Boxes A and B represent the two factors that determine the amount of human resources available to the nation. The essential difference between these two factors is the susceptibility to planned, policy-induced change. By population base we mean exogenous characteristics that cannot be affected (at least in the short term) by government authorities. These include the size, age, and urban distribution of the population, and the sociocultural characteristics of that population that have a bearing on military performance. Important among these are mechanical and mathematical aptitudes; attitudes toward authority, manual labor, long hours of work, and the giving and acceptance of criticism of poor performance; orientation toward individual versus group accomplishment; and acceptance of new, technically advanced ideas.

Some social relations are particularly important: (1) the ability of people who are skilled but not well-connected (genealogically or politically) to rise to positions

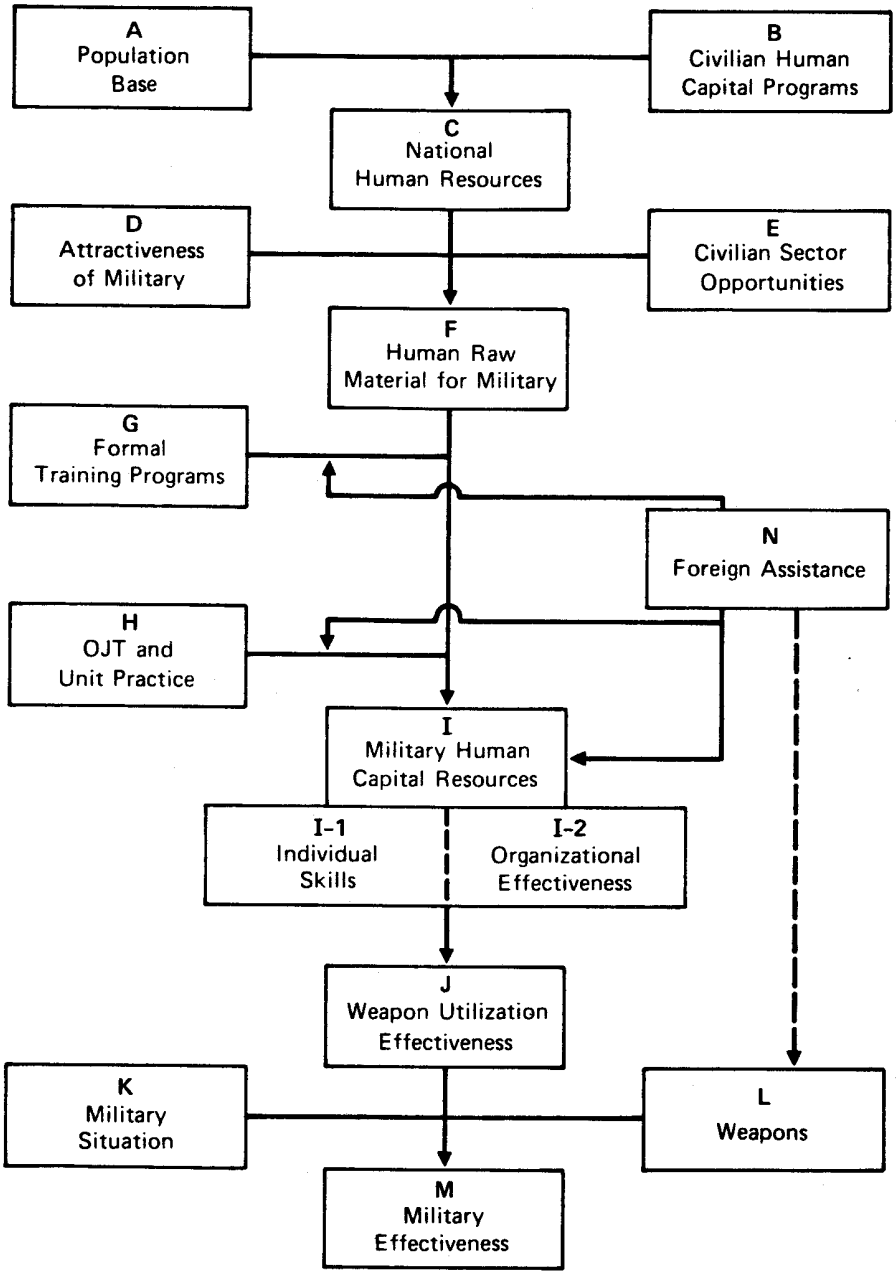

Fig. 1 — Conceptual flow-chart: the role of human capital in military effectiveness

of power and *effectively exercise* it; (2) attitudes toward participation by women in the military labor force; and (3) attitudes toward less favored ethnic groups or foreigners. To call any of these factors "exogenous" is not to imply that they cannot be changed to some extent by conscious government action. However, they are phenomena that we expect to change rather slowly with respect to our time frame of interest. One must certainly be on the lookout for changes in these factors. Clearly, government programs to foster economic development will tend, directly or indirectly, to alter many attitudes with pre-industrial roots. But sociocultural factors will operate as critically important constraints on military effectiveness, in much their present form, for years into the future.

The second determinant of the kinds of human resources available to a country is the level and effectiveness of its civilian human capital programs—basically health, nutrition, and education. These are discussed in Sec. III. The *kind* of education received dominates average years of attainment in its importance for producing manpower valuable to the military. Mathematical, scientific, mechanical, and foreign language training will help in molding individuals who can contribute to a modern military force; text memorization and religious training are much less appropriate. In our human-resource-determination dichotomy, these health and education components are the endogenous branch. We must evaluate not only the current health and education levels of the population but also plans for changing these levels through more extensive or effective education programs, new health and nutrition initiatives, etc. There will then be a considerable time lag between improved human capital efforts and the availability of a more productive labor force.

THE ALLOCATION OF MANPOWER BETWEEN CIVILIAN AND MILITARY SECTORS

The population base and human capital programs determine the size and quality of the national labor force. We must next consider how much of this labor force the military is able to obtain. In states that do not utilize conscription, this is determined by the relative attractiveness of the civilian and military sectors in terms of pay, prestige, prerequisites, and opportunity for advancement. Even countries that do not depend on volunteers for their military manpower supply will find that morale, and perhaps retention, will be poorer the lower the attractiveness of the military sector relative *to the civilian.*[1] In many countries of the world, the sharp distinction between volunteer and conscript forces breaks down as more advantaged segments of the population exploit various "deferment" options. In addition, some tasks in any military organization are, in fact, restricted to volunteers. In any case, conscription policy is a key variable.

One has difficulty disentangling boxes E and D, however, because of at least three forms of interaction among them. First, the military may be viewed as a source of training (mechanical, language, etc.) for later use in the civilian sector. This eases the recruitment but makes more severe the retention problem. Second,

[1] An important underlying exogenous factor that we must always keep in mind is the dynamism, or growth prospects, of the civilian economy. Its current and projected performance will obviously color quite profoundly the perceptions of young workers in their civilian-military choice. This aspect of the economies we are studying is discussed in Sec. III.

some military personnel may hold part-time civilian positions. This may detract from military performance, but it may be a superior solution for the military than losing skilled people altogether. Finally, civilians can be hired for many military tasks.

We were able to uncover very little information on how the Middle Eastern militaries assign manpower to various military functions. Diagnosis of basic skills and aptitudes, evaluation of the effects of training, periodic performance review, and management incentives toward appropriate slotting are obviously important aspects of personnel assignment systems. We attempted to assess the probable quality of assignment procedures by examining other related military organizational forms, as in training, maintenance, and supply.

TRAINING AND PRACTICE

Once the size and quality of the pool of military raw material has been determined, its usefulness in military work will be shaped by the nature of its training programs, on-the-job training (OJT), and unit practice. A critical consideration is the prioritization of units in assignment of high quality manpower, receipt of training, and allocation of material for practice and exercises. It is insufficient to examine training programs or practice schedules for a single unit. In fact, certain branches of the armed forces (particularly those that use sophisticated, prestigious imported weapons) probably get the *best personnel* as inputs into training, the *best* (and thus most expensive) *training programs*, and the *most thorough* (and thus most expensive) *unit practice regimes*. In our summary attempts to evaluate armed forces' effectiveness as a whole, we believe that prioritization has important implications for the general military situation.

When examining individual training programs, we sought answers to the following questions:

1. When recruits entered, how good were they compared with U.S. recruits?
2. Did they have good motivation and attitude toward work?
3. Did the syllabus seem suited to their characteristics, or did it need modification?
4. Were criteria for passing acceptable by U.S. standards?
5. What were throughput, washout, and recycle rates, and how did these compare with plans?
6. When recruits graduated, how might they be compared with U.S. graduates?

Our use of U.S. trainees and graduates as a standard of comparison stems from the U.S. origin of the weapon systems we were studying, as well as its convenience in giving an admittedly subjective and somewhat nebulous yardstick to use across various sources of information. We paid particular attention to three further aspects of training. The first was the effect of foreign rather than domestic location of training, as well as implications of using foreign instructors directly rather than using foreigners to train domestic cadres. In this connection, prospects for training self-sufficiency were evaluated. Second, we looked especially hard at the time trend of performance in training programs, seeking evidence of the "bottom of the bar-

rel" phenomenon, in which the magnitude of the force modernization program exhausts the supply of capable personnel, forcing the use of less suitable inductees. This kind of evidence conveys an important message for the future, of course. Finally, we took account of intertemporal substitution possibilities to achieve military readiness. It is possible to move the best personnel from operational assignments to advanced training programs. This has a detrimental effect on current readiness, as less qualified personnel fill in; but it has a salutary effect in future years, as the now improved top people regain their positions. Information about these kinds of developments would also aid prognostications.

After formal training, military personnel join their operational units, and a key determinant of the readiness of these units is the level and kind of exercises and OJT in which they engage. With respect to OJT, we asked:

1. What is the quality of entrants into OJT from the training programs, evaluated on a U.S. standard? (This repeats the last question posed about training programs.)
2. What is the motivation and attitude of OJT participants?
3. Is OJT actually pursued at scheduled rates?
4. As it is pursued, is it effective in terms of realism, discipline, proper supervision, vigorous criticism, and correction of faults?
5. If it is not effective, is this because of perverse incentive schemes?
6. As personnel progress through skill levels, what is their actual capability ranked on a U.S. scale?

Here again, we tried to examine differences in OJT practice and results as experienced under both foreign and domestic supervision.

Corresponding to OJT at the individual level is military exercise at the unit level. Two kinds of exercises are important in maintaining readiness. The first is routine, day-to-day practice, which keeps skills sharp, ensures that equipment is in working order, and is closely linked to routine maintenance. A second is surge or periodic exercise, in which capabilities are strained and actual combat situations are simulated.

We examined the extent of both routine and surge practice, paying special attention to these factors:

a. Are the exercises realistic with respect to the (natural, electronic) environment?
b. Are the results accurately monitored, and *correctly reported* to appropriate supervisors?
c. Are there adequate incentives for those responsible for exercises to carry them out?
d. Are there differences in foreign and domestic supervision schemes?
e. Are exercises realistic with respect to the military environment—e.g., combined arms?

We sought information on the relation between exercise and true combat performance. If certain exercises are ignored or inadequately performed, how much does this degrade combat performance? Or, put another way, can the military forces, in times of crisis, suddenly adopt modes of operation that have never, or only poorly, been rehearsed? If not, how close can they get?

Operator and Maintenance Skills

We analyzed in particular operators (pilot, fire control officer) and hands-on maintenance personnel (fault isolation, item repair, routine calibration). Our measure of individual skill level is based on comparisons with U.S. personnel in mechanical aptitude, discipline, initiative, performance under stress, and manual abilities. This measure is necessarily subjective and imprecise, but it is at least comparable across different data sources and, because skill is itself imprecise and subjective, avoids the misleading appearance of numerical accuracy.

In evaluating the production of individual skills, we studied four points in the training process: entry into the military, end of formal training, progression through OJT, and average skill levels post training. In trying to explain the improvement rates as personnel pass through these points, we concentrated our investigation on the following postulated key determinants of the effectiveness of skill enhancement programs:

1. Student motivation and attitude toward work.
2. Appropriateness of syllabus, especially with respect to cultural orientation and initial skill level of students.
3. Instructor incentives for pupil advancement.
4. Domestic vs. foreign location of training.
5. Objectivity of evaluation.
6. Access of ultimate superiors to accurate information about student progress.

In addition to measuring local personnel against U.S. standards, we examined several other measures that may shed light on the situation: (1) comparison of personnel with those of other countries in the region, (2) comparison of current with past personnel, and (3) dependence on foreign personnel. Our basic interest is after all in forecasting future levels in military effectiveness and autonomy.

Finally, we investigated the role of technical change in making certain skills either more or less important. As new systems are introduced, these developments will strongly influence what kinds of manpower constraints will be most important in the future. An example of a change designed to alleviate skill shortages is modular design of systems leading to direct exchange ("black box" approach) vs. direct repair methods of maintenance. But we recognized that black box approaches may end in escalating the demand for diagnostic skills and sophisticated supply systems that position the black boxes where needed.

ORGANIZATIONAL FORMS

The adequacy of organizational forms for accomplishing necessary tasks is the other major aspect of human capital that is relevant to military effectiveness. The human capital devoted to management combined with administrative structures determines organizational effectiveness. We looked specifically at two kinds of organizations: maintenance arrangements and supply schemes.

By maintenance arrangements, we mean the ability of the system to adequately carry out routine maintenance (schedule equipment and assign personnel correctly), diagnose infrequently arising problems, and assign proper personnel and equip-

ment (from stores or cannibalization) to solve them. We sought to investigate three crucial aspects of maintenance organizations in trying to explain the success or failure of various units in carrying out their tasks:

1. Location of responsibility, location of authority, and motivation schemes facing personnel, with special attention to the existence of rewards and sanctions for performance.
2. Relations of superiors to workers: interpersonal attitudes toward authority, discipline, personal criticism, and correction of faults.
3. The actual management skill level of the supervisors themselves, in both fault diagnosis and personnel administration.

Finally, we examined with particular interest the role of foreigners in sustaining maintenance effectiveness at current levels. Two metrics of self-sufficiency seemed important: the year when manning requirements could probably be met out of domestic personnel (except those personnel who by definition are foreign—e.g., manufacturer's technical representatives) and the length of time operations could proceed (and their time profile of degradation) if foreign personnel were suddenly to leave the country.

We did a similar analysis of certain supply systems. We viewed a supply system as containing two crucial components: an effective *information flow* system (from base to depot and from depot to supplier) indicating what spares or expendables are needed; and a *management incentive* scheme, which encourages holders of supplies to release them in a timely fashion and demanders to forward requests so as to maintain only appropriate unit inventories.

Determinants of the effectiveness of the information flow system include

a. Its physical manifestation—e.g., hard copy or electronic.
b. The level of stockpiles and their dispersal (overstocking can compensate for other organizational defects and enhances effectiveness).[2]
c. The human capital skills and experience of the individuals in charge (e.g., whether those in charge of ordering spares consider average lifetimes of equipment, thereby anticipating failure rather than awaiting it).

In our analysis of supply, as well as other aspects of human capital, we concentrate on changes over time, both historic and prospective, and the current and future role of foreigners in the system.

FOREIGN ASSISTANCE

We have noted at several points the role of foreigners in such activities as organizing and running training and practice programs and in directly augmenting domestic personnel. Any evaluation of the current and prospective military effectiveness of a country must, of course, consider how much such effectiveness is maintained through foreign support. The flow chart in Fig. 1 indicates three impor-

[2] This is often referred to as the "hoarding problem." Incentives may be so structured that supply managers are induced to keep material rather than release it when appropriate. Operating units may anticipate hoarding and compensate by "over-ordering." This is partly a cultural problem, but it is also partly a problem of the military management, inspection, and reward system.

tant ways in which foreign assistance may be instrumental in determining how well militaries perform. First is use of foreign personnel in organizing and staffing formal training programs. Next is their use in designing, supervising, and enforcing exercise and practice schedules. Finally, foreigners (civilian or military) may directly perform military tasks, simply supplementing domestic personnel. Both insufficient numbers and inadequate quality of indigenous people can lead to dependence on foreigners, assuming the host country can afford to hire the services.

The implications of the presence of foreigners for military effectiveness may be quite complex and was the subject of considerable research. Aside from their obvious beneficial effect in adding human capital skills to the domestic military force, foreign nationals may have detrimental effects. For example, foreign supervisor-teachers may have little incentive to ensure that their trainees-subordinates advance in skill level, because sufficient advancement would imply that the foreigners are not longer needed. Further, host military officers may use the presence of foreigners to avoid making decisions and taking responsibility for mistakes but thereby lose useful command experience.

Critical, too, is the implication for the military autonomy of the country in question. Presumably, dependence on a large foreign supervisory and operational presence limits the military options the country can realistically exercise, in view of the consequences of a foreign military pullout. It is for this reason that, as mentioned above, we posed some of our questions about current and prospective human resource levels in terms of how soon reasonable self-sufficiency might be reached, or in terms of how long, and at what level, operations could be maintained in the face of a foreign pullout. But these are very complex questions, and at least three have to be kept in mind:

1. Foreign personnel may participate in front line or support activities.
2. Foreigners may originate from many different countries (heterogeneity may itself pose problems).
3. Many of the foreigners in the region are manufacturers' technical representatives, whose required participation may extend for a very long time indeed.

The importance of the final point merits its further development. Even a country that has reached "self-sufficiency" would still presumably employ technical representatives, and given the U.S. origin of many of the weapons, most would probably (but not necessarily) be U.S. citizens. Thus, a foreign pullout even after "self-sufficiency" could seriously harm military potential for a time. These considerations lead naturally to another flaw in the definition of "self-sufficiency." Presumably, at least, some depot repair and much spare part supply will come from the United States regardless of the level of self-sufficiency in other spheres. Thus, the threat of a service or resupply embargo will always have some effect and make any simple notion of self-sufficiency untenable.[3]

The size of the foreign presence and the specific role of foreigners are very important in determining ultimate military effectiveness, present and prospective. One must consider the implications of changing, especially reduced, levels of for-

[3] Even here substitutes are available if the main supplier cuts off support: for example, surreptitious third party transactions and use of alternative primary parts and repair suppliers (namely, Western support of Egyptian MiGs).

eign support in evaluating how well weapons might be used in specific future scenarios; but the issues are sufficiently complex that definitive answers certainly cannot be expected.

MILITARY EFFECTIVENESS

The schematic "bottom line" in Fig. 1 argues that ultimate military effectiveness is a function of three things: the military situation facing the country, the size and kind of its weapons stock, and the military human capital resources it has available. The human capital resources determine how effectively the weapons themselves will be used. Given the military situation, men and arms determine the outcome.

We did not aspire to build a model of military outcomes. However, we were continually aware that the significance of the ability to use weapons effectively is strongly contingent on the military situation the country expects to face. Here we simply list those military contingencies that seem most important.

Offensive vs. defensive posture.
Surprise vs. pre-planned combat.
Limited war of attrition vs. all-out war for territory.
Prospect for immediate foreign resupply of expendables.

An example may be useful to explain why it was crucial for us to consider the military context in making judgments about weapon effectiveness. Measures of effectiveness must include aircraft dispersal, site hardening, and ability to scramble if surprise attack is expected, but these measures may not be necessary if surprise attack is not expected. Judgments about effectiveness thus must accommodate the goals and expectations of the military decisionmakers.

Two kinds of measures of utilization effectiveness are possible—numerical and judgmental. (For convenience, we will now specialize our discussion to aircraft. Similar considerations, but different acronyms, apply to other kinds of equipment.)

The main numerical measure is the mission capable (MC) rate, formerly called the operational ready (OR) rate. The MC rate is the percentage of aircraft that, at any given time, are capable of carrying out their specified mission. Not-mission-capable aircraft are broken down into not-mission-capable-maintenance, NMCM (those needing maintenance work) and not-mission-capable-spares, NMCS (those needing some part).[4]

We have been continually warned of the inappropriateness of MC rates as measures of effectiveness in weapon use, for two reasons: (1) MC rates are static and do not express the potential to generate effective sorties in a combat situation; and (2) MC rates may be sustained by refraining from flying aircraft, with obvious implications for training schedules and experience of both pilots and ground crews. Nonetheless, MC rates (or their equivalent) are currently the common measure of readiness, and we have collected what data we could on them. We have attempted to be sensitive to their limitations and have gathered what other numerical measures we could find as well. These include sortie rates, planned and actual practice

[4] NMC aircraft are also divided into those flyable and those grounded.

use of equipment, and test scores of trainees. Although the information tends to be spotty, it is often enlightening.

By far our most important source of information is informed judgment. We generally asked personnel experienced in the countries in question themselves to evaluate the effectiveness of weapon use. We immediately noted two problems with this procedure:

1. Answers were seldom precise.
2. Answers were colored by the peculiar experiences of the interviewee and thus necessarily subjective.

We tried to overcome the second problem by interviewing many people, both civilian and military, both high and low ranking, and both with in-country experience primarily and mainly observing from the United States. Comparing anwers across these categories was often in itself illuminating.

The first problem is, of course, more difficult. We sought to sharpen answers by asking for hypothetical intercountry combat comparisons or "If Country X and Country Y fought a certain kind of battle with certain specific, identical equipment, who would win? By how much?") or for simple rankings of countries ("Rank these countries according to their ability to utilize a specific weapons system," recognizing that "utilize" implies a specific kind of mission.) We also asked for judgments about combat outcomes. Another technique was to ask for evaluation against a background of a specific military scenario ("If Country X attacked Country Y, each with its own peculiar equipment, what would the outcome be? How will this change in future years?"). We found those kinds of questions fruitful in eliciting comments about skill levels and organizational adequacy. Interviewees rarely otherwise volunteered comprehensive evaluations.

The reader should recognize judgmental evidence about military effectiveness for what it is: opinions of informed people about future events. We feel, however, that such information has increased our ability to understand and project the role of human capital in the military situation in the Middle East.

The reader must use his own judgment on the usefulness of this approach, of course. But given the inherently nebulous and non-quantifiable nature of such notions as skill, organization, and effectiveness, this judgmental evidence may in the end be the most appropriate of all.

III. INDICATORS OF SOCIOECONOMIC MODERNIZATION

Our definition of general modernization hews fairly closely to the standard ones. We examine growth in physical output, changes in population and labor force, investment in human capital, and the attitudinal changes these various phenomena imply.[1] The objective of these efforts has been to gain a better understanding of the nature of change in the three key societal characteristics: (1) the pool of technical talent available in the society, (2) the supply of skilled managerial personnel, and (3) the ability of the society to develop and sustain the institutional infrastructure necessary to solve problems in administration, production, and, finally, security. Without technical capacities, skilled management, and effective organizations the development process will not proceed rapidly. But it is also true that as development proceeds, technology, management, and administration improve together.

There are more pragmatic reasons for concentrating on these particular concomitants of development. Most observers agree that in past confrontations with Israeli forces, the Arab deficiencies have been precisely in the realms of management and organizational effectiveness and in technical capabilities, although less in 1973 than in earlier wars.[2] Substantial disparities between the two sides have been apparent in their abilities to marshal military resources, execute actions—particularly in fluid battlefield situations—and exploit and maintain complex modern equipment.

In some cases we have been able to develop quantitative measures of development—e.g., educational trends, production of engineers and scientists, industrial performance. For many other variables of interest we have been obliged to blend opinion, judgment, and indirect evidence into more subjective evaluations of the rate of progress.

The themes treated in this section appeared to us to be the critical elements necessary to an assessment of general mobilization trends and prospects. That is, economic growth and transfers from other states provide the wherewithal to finance military undertakings, and the size and quality of the manpower pool largely determine how well physical resources will be exploited. Quality depends on investments in domestic and foreign education and on immigration and emigration. Scientific endeavors reflect how much a country has developed a "pro-technology" outlook. Finally, the cultural milieu, as mirrored in endemic attitudes, influences how well various factors may be combined to produce desired outcomes. The space devoted to each theme does not reflect our conviction as to its relative importance but rather the degree to which the findings are based on our own research compared with generally available information.

[1] We also explore the sharing of resources among the various Arab states.

[2] Analysts of past wars have also identified important differences in the will to fight between the two sides. This differential may in fact be narrowing over time and is even more elusive than the other qualities we have been discussing. Motivational problems are not emphasized in this report.

ECONOMIC GROWTH

Table 1 indicates projections of rates of growth in the principal Arab states as derived by Smithies in a companion study.[3] The figures portray the dominance of the Saudi economy in both current and prospective wealth. In per capita terms it exceeds its nearest rival, Iraq, by more than 4 to 1 and Egypt, easily the most populous, by about 20 to 1. Iraqi wealth and growth prospects also appear impressive. Syrian development looks rapid but the base is low. The very small relative size of Jordan's economy comes through clearly.

Table 1
COMPARATIVE ECONOMIC POSITIONS OF THE ARAB STATES, 1975 AND 1985
(Constant 1975 dollars)

	GDP[a] (billions)		Non-oil GDP (billions)		GDP Per Capita (thousands)		Accumulations (billions)		Population (millions)	
Country	1975	1985	1975	1985	1975	1985	1975	1985	1975	1985
Saudi Arabia	38.0	61.1	5.6	15.2	6.1	7.3	56	79-121	6.2	8.4
Egypt	12.4	21.4			.3	.4			37.1	47.6
Syria	4.7	9.0			.6	.9			7.4	9.9
Jordan	.9	1.7			.5	.6			2.0	2.7
Iraq	13.6	22.5	5.3	10.8	1.2	1.5	4	26-42	11.1	14.9

SOURCE: IMF *International Statistics;* IBRD *World Tables.*

[a]1985 GDP figures for the oil-rich assume export income increasing at 3.5 percent annually.

[b]Population figures assume 1975 population increases at 3.0 percent annually with the exception of Egypt, which is assumed to increase at 2.5 percent. Population figures are unreliable because of the difficulty of dealing with migrants in both years.

POPULATION AND LABOR FORCE

Table 2 presents demographic indicators developed to portray the nature and dynamics of population and labor forces for the Middle East states and permits comparisons among them. Egypt, the most populous, and Jordan, the least populous of the Arab states, demonstrate certain similarities: for example, in urbanization proportions and health indicators. They both rank fairly high in adult literacy and female labor force participation. Although among the most Westernized of the states, they both lack sufficient internal resources for rapid growth. Saudi Arabia and Iraq began from a lower base; the flood of oil revenues occurred too late for results to appear in available published statistics. Syria occupies a middle ground in both Westernization and export wealth, but we believe that the available statistics for Syria are the least reliable of any of the states, given what we have been able to learn about that country from other evidence.

[3] Arthur Smithies, *The Economic Potential of the Arab Countries*, The Rand Corporation, R-2250-NA, October 1978. No separate research was commissioned on growth trends for Iran and Turkey.

Table 2

GENERAL INDICATORS OF POPULATION AND LABOR FORCE STATUS IN SELECTED MIDDLE EASTERN COUNTRIES, VARIOUS YEARS

Indicator	Egypt	Iraq	Jordan	Saudi Arabia	Syria	Turkey	Iran
Population							
Current size (1975)	37,230,000	11,120,000	2,690,000	8,970,000[a]	7,350,000	43,059,000	35,000,000
Growth rate (percent, 1970-1975)	2.2	3.3	3.3	3.0	3.3	2.6	3.1
Labor force	(1973)	(1975)	(1975)	(1975)	(1974)	(1970)	(1976)
	9,266,900	2,786,000[b]	429,406	1,600,000	1,718,546	15,118,887	10,000,000
Urbanization	(1975)	(1975)	(1974)	(1975)	(1974)	(1976)	(1976)
Percent urban	44.6	63.7	42.0	35	45.9	44.5	58.2
Rate of change in urban population (percent, 1967-1975)	+ 3.8	+ 9.8	NA	NA	+ 4.3	+ 4.5	+ 5.0
Literacy							
Adult literacy rate (percent, 1970)	40	26	62	15	40	55	37
Rate of change in literate population since 1960 (percent)	+20	+ 11	+ 30	NA	+ 4	+ 2.53	+11.8
Life expectancy (1975)	54.9	55.2	55.7	47.8	56.5	55	50
Percent of per capita calorie requirements provided in food supply (1970)	94	93	94	86	102	110	86
Female participation in the labor force	(1975)	(1975)	(1975)	(1975)	(1974)	(1970)	(1976)
Percent of women in labor force	3.1	2.2	5.6	1.0	8.2	38.4	13.0
Rate of change in female participation in labor force since 1960 (percent)	-1.7	+ 0.21	+ 3.0	+ 0.5	+ 2.8	- 0.76	+ 5.7

SOURCE: World Bank, *World Tables 1976; United Nations Demographic Year-book, 1976;* ILO, *Yearbook of Labour Statistics,* 1976.

[a]Other (and perhaps more reliable) estimates place the Saudi population at less than 6 million.

[b]This figure is from the ILO Labor Force Estimates and Projections. The other figures in this row are from the ILO Yearbook of Labor Statistics (Egypt, Jordan, and Syria), the ILO report "Manpower and Employment in Arab Countries" (Libya) and the Saudi Arabia Five Year Plan, all of which seem to give more conservative estimates of the labor force than the ILO Labor Force Estimates.

[c]The ILO Labor Force Estimates and Projections estimates that in 1975 2.56 percent of Saudi women were active in the labor force. The estimate of 1.0 percent is from the Saudi Arabia Five Year Plan.

Turkey and Iran shared many characteristics, although Turkey scores higher in literacy and female labor force participation and lower in urbanization; the statistics indicate a coming convergence.[4] Generally, they appear to rank with the leading Arab states on most indicators.

PROGRESS IN INDIGENOUS EDUCATION

Syria, according to published figures at least, enrolls the largest fraction of the age-eligible population at the first two educational levels (see Table 3). Statistics for Jordan and Turkey are also impressive. Egypt seems to do a middling job at the primary level and relatively much better at the secondary, as does Iran. The Saudi figures are the least impressive, but significant changes may well have occurred there since 1973. At the university and institute level, the Egyptians stand out. The Jordanian and, to a lesser extent, Iranian third level figures are low because so many of their students study abroad.

Iraq and Turkey appear to make the greatest effort in education, devoting some 20 percent of the government budget. The Egyptian, Iranian, and Syrian fractions rank next, and the Jordanians and Saudis appear to make the smallest effort.

In priorities, the indicators show that Iran especially and then Syria, Iraq, and Saudi Arabia place the greatest stress on science and engineering. Egypt and Jordan lag rather markedly.

The figures on fractions of students studying abroad are affected appreciably by the availability of adequate facilities at home. The contrast between Syria and Iraq in this regard, because they have similar indigenous educational infrastructures, is thus illuminating.

In none of the Arab States has public education broken free of the conventional Islamic mode of instruction. The approach to education in the Middle East stresses both traditional subject matter—religion, history, Koranic law—and pre-modern pedagogy, in which authoritarian teachers use drill, memorization, and strict obedience to convey a fixed curriculum. Changes are underway, but reform is slow. Thus, bald statistics on educational attainment probably conceal appreciable quality differences between Middle Eastern and Western students in such subjects as science, mathematics, and foreign languages.

ARAB STUDENTS IN THE UNITED STATES

The number of Arab students studying abroad has shot up dramatically since 1960. Until 1970 more than 40 percent of them went to Egypt and Lebanon (especially from Syria and Jordan to Lebanon) with about 10 percent to other Arab states. Of those studying outside the Middle East, the shift has been from Europe (East and West) toward the United States and away from arts, humanities, and social sciences toward engineering, land sciences, and education.

We surveyed U.S. institutions that enrolled university students and technical specialists training for various aspects of airline operations. We chose institutions

[4] Before the recent upheaval.

Table 3
GENERAL INDICATORS OF EDUCATIONAL PROGRESS IN SELECTED MIDDLE EAST COUNTRIES, VARIOUS YEARS

Indicator	Egypt	Iraq	Jordan	Saudi Arabia	Syria	Turkey	Iran
Enrollment[a]							
First level							
Number enrolled (1973)	3,980,396	1,408,929	352,696	570,697	1,160,088	5,324,707	3,646,421
Gross enrollment ratio (percent)	70	79	81	42	101	108	69
Net enrollment ratio (percent)	66[b]	67	NA	31	92	85	NA
Second level							
Number enrolled (1973)	1,775,327	405,006	125,928	148,753	440,789	1,516,880	1,778,469
Gross enrollment ratio (percent)	37	28	38	13	47	30	41
Net enrollment ratio (percent)	31[b]	NA	NA	9	39	24	NA T
Third level							
Number enrolled at home (1973)	326,493	65,481	8186	14,882	56,162	185,285	123,114
Gross enrollment ratio (percent)	11	7	4	2	10	6	4
Education effort							
Percent of all government budget allocated to education	(1973) 17.6	(1973) 20.8[c]	(1974) 8.4	(1973) 9.7	(1973) 11.7	(1972) 20.6	(1973) 11.1
Percent of GNP spent on education	5.8	4.2	4.0	8.0	4.0	5.6	3.2
Educational priorities							
Percent of third level students in science and engineering (1973)	16	26	15	20	28	30	51
Percent of third level students studying abroad	2	6	77	NA	18	4	20
Total number studying abroad (1972)	5062	3376	21,764	2546[d]	11,267	8292	24,284

SOURCE: UNESCO *Statistical Yearbook, 1976*; World Bank, *World Tables 1976*.

[a]The gross enrollment ratio is the total enrollment at each level divided by the population of the age group (6-11 year olds for the first level, 12-18 year olds for the second level, 20-24 year olds for the third level) corresponding to the age groups for each level; the net enrollment ratio uses only the part of the enrollment that corresponds to the age groups for each level.

[b]These figures refer to 1972.

[c]Current expenditure only.

[d]This figure is for 1975. It includes 1603 undergraduate students and 943 graduate students.

that enrolled substantial numbers of Arabs but varied significantly in selectivity. The national origin of the students, instruction level (graduate and undergraduate), and field of study are cross-tabulated in Table 4. The dominance of the Saudis and of engineering and education as fields are striking features. So is the unexpectedly low number of Iraqi students, given that country's wealth, although there may be large numbers of Iraqis studying in the Soviet Union and Eastern Europe.

Comparing our data with figures from 1973-1974 supplied by the Institute for International Education, we find evidence of a substantial shift in the origins and fields of study for Arab students attending American educational institutions since 1973. The great increase in oil revenues has permitted exporter states to send many more, and it has incresed the demand for trained manpower in development efforts in these same states.

Certain characteristics and factors were found to influence the performance and behavior of Arab students on American campuses. The Arab student generally completes his degree program although the process may be time-consuming (e.g., changing majors, changing schools, repeating subjects), evidencing a strong commitment to the credential. A degree from an American institution, almost regardless of the field, is regarded as a ticket to high status at home.

Differences occur by country in the proportion of Arab students who eventually return home after completion of their degree; Egyptians, Jordanians, Syrians, and Lebanese have tended to stay in the United States after completing their education, but increasingly the booming economies in the Persian Gulf attract many. Moreover, students from these countries have tended to be self-supporting and thus without contractual obligations to return home. By contrast, students from Saudi Arabia, Kuwait, the Gulf states, Libya, and Iraq increasingly come under government sponsorship and now nearly always return to their home countries where economic conditions assure high pay and high status.

Certain factors seem to influence the chances that the Arab student will succeed in his academic endeavors: age, marital status, opportunity to visit home, and school selected. Generally speaking, older, married men, accompanied by spouses, who have opportunities to visit home annually tend to make better students, especially if they have already had work experience and have a fairly concrete idea of the skills they wish to gain from their U.S. academic experience. Selective institutions that have not attracted so many Arab students as to provide insulated environments seem to offer the best milieu for good performance.

The younger student, single, with vague career goals and no working experience, and who is often immature in the context of his own culture may suffer from culture-shock at American institutions. He tends to lack commitment and perseverence, becomes involved in legal and other difficulties, and reacts quite strongly to American culture, sometimes in the form of super-Americanization in dress, language, and behavior.

The academic difficulties encountered by Arab students emerge mostly out of an orientation to knowledge and learning that has very different roots from the American approach. In Islam, knowledge is given by Allah, and the teaching methods used in religious schools have been adopted by secular schools as well. Knowledge is not generally regarded as a product of human reason and thus subject to expansion and interpretation; rather it is a gift one captures and with which one is "adorned." Cause and effect relationships are not stressed. Memorization and imitation are primary learning methods.

Table 4
ARAB STUDENTS ATTENDING SELECTED AMERICAN UNIVERSITIES AND TECHNICAL SCHOOLS, 1976-1977[a]

Country	Computer Science		Engineering		Physical Science		Agriculture		Education		Business and Economics		Arts and Sciences		Public Administration	Other Professional		English Only[b]	Unknown	Aircraft Technician	Total		Academic Total	Grand Total
	U	G	U	G	U	G	U	G	U	G	U	G	U	G	G	U	G				U	G		
Egypt	0	2	7	51	1	16	0	9	0	22	0	10	12	8	0	1	13	15	8	3	21	131	175	178
Iraq	0	2	3	13	1	8	1	18	2	7	2	7	2	15	0	1	8	2	3	312	12	71	88	400
Jordan	1	0	51	17	3	9	0	3	1	4	10	14	14	12	3	2	8	1	7	17	82	70	160	177
Saudi Arabia	1	3	99	25	1	8	1	15	14	90	11	21	21	58	37	4	37	163	10	45	152	291	616	661
Syria	2	0	10	9	0	4	0	0	0	0	1	1	9	4	0	3	2	1	2	11	25	20	48	59
Kuwait	0	0	36	12	2	2	1	0	2	9	1	11	3	6	2	1	4	31	3	458	46	46	126	584
Libya	15	6	67	38	7	3	0	18	0	22	5	13	2	21	2	4	7	15	8	43	130	100	253	296
Other Peninsula	1	0	30	3	6	0	0	0	0	2	2	1	15	1	0	2	1	22	5	6	56	8	91	97
Sub-totals	20	13	303	168	21	50	3	63	19	156	32	78	78	125		18	80				524	737		
Totals	33		471		71		66		175		110		203		44	98		250	46	895			1557	2452

[a]University of California, Berkeley and Los Angeles; University of Arizona; University of Texas, Austin; Texas A&M; University of Houston; Tulsa University; University of Illinois; Indiana University; Ohio State University; Michigan State University; University of Southern California; Spartan School of Aeronautics; Northrop Institute of Technology. U = Undergraduate; G = Graduate.

[b]Enrolled in English language instruction only.

Moreover, because memorization is a literal technique, knowledge acquired in this way is difficult to transfer to new, unfamiliar situations. In this approach to learning, powers of analysis and generalization go undeveloped. The technique of memorization limits flexibility and adaptability of learning. Individual creativity is downplayed. In tests of vocabulary, Arabs do well; in tests based on analogies, they score low. The strong Arab sense of shame may also make them somewhat timid and unadventurous as students. Fear of being wrong, of losing face, will inhibit the Arab from going beyond the conventional bounds of the subject under study. Originality and initiative are not highly regarded.

Arab students' academic behavior also reflects an emphasis on group or collective accomplishment, as opposed to the American norm, individual achievement. One of the consequences of this value system is the high reported incidence of cheating among Arabs at American institutions. To refuse to help a compatriot is thought dishonorable.

Arabs also tend to be goal-oriented rather than process-oriented. The attainment of an American university degree is considered a desirable objective, leading to improved social status and financial condition. However, the process of education that must be pursued to earn the degree is underemphasized. Thus, many Arab students arrive, proud and confident, expecting to advance quickly to their goal once selected for foreign study. They often face a severe shock on discovering that a good deal of hard work must precede the end they seek. Shortcuts such as cheating, grade haggling, and cajolery may be attempted, because it is the receipt of the degree and not the methods used in obtaining it that seems most important.

Undeveloped mechanical aptitudes seem to characterize Arab students generally, although this charge was made most frequently about students from the oil-rich states. A complex of factors appears responsible. The cultural aversion to manual labor is one component. Another is the lack of experience with machinery—cars, stereo kits, ham radios—among youth. And the schools attended by these students would have had much less in the way of labs and science equipment than the typical American, European, or Japanese high school. However, most observers regard this difficulty as largely remediable with adequate training and exposure to equipment. Instilling real excellence in the research laboratory, however, may have to await a higher quality indigenous science education system and more frequent exposure to mechanical apparatus while the students are growing up.

Arab students have been characterized as shrewd, politically astute to the nuances of human behavior but noncreative and nonanalytical in thought processes. Face-to-face associations are highly valued; opportunities for verbal confrontation, especially on a group basis, are eagerly welcomed. However, written work that requires solitude and individual effort tends to be shunned. All in all, the Arab students studying in the United States reflect the culture and experience of the societies from which they come. We have chosen to stress areas of weakness rather than strength because the former better reveal the problems of the various societies in dealing with the modern world and with a very modern adversary.

SCIENCE AND TECHNOLOGY IN THE ARAB WORLD

We offer an abbreviated discussion of science and technological developments in the Middle East not because we believe that all states, however small, must

engage in basic research but because we believe that serious attention to these matters reflects a commitment to modernization and the aggressive absorption of advanced technology.

Aside from Egypt, whose situation differs by orders of magnitude, the Arab states evidence only the very early stages in development of a scientific and technological infrastructure. In some countries, an awareness of the importance of science and technology is only now dawning. Although bodies to plan and coordinate scientific efforts may have existed on paper for over a decade, in most cases these did not really become active until the 1970s—and after 1973 as a rule. In the absence of any planning or goal-setting, universities have conducted most of the research, which has often been poorly financed, with inadequate equipment, poor library or other documentational support, and murky priorities.

Applied research has been too expensive even for governments to support in many of the countries (e.g., Jordan, Syria). Government-sponsored efforts have mostly dealt with practical matters—water resources, agriculture, climate. Basic research has been mostly abjured as an activity whose ultimate product can be purchased more cheaply through imports of industrial technology.

Frequently, reports note that even more than qualified scientific and engineering personnel, the Arab states lack trained technicians to support research application efforts. Causes lie in the poor pay and low status accorded these jobs and in the absence of scientific elements in the conditioning culture such as popular science magazines, scientific toys and games, and opportunities for youngsters to be exposed to mechanical apparatus. Aversion to manual work may also inhibit the development of technician training institutions, of which only Egypt has significant numbers.

The scientific and technological enterprise in these states is affected by low financial rewards, poor chances for advancement, low social status, heavy administrative burdens, and isolation from the world of science. Language barriers play a role as do the paucity of publications in Arabic. For these reasons, a large fraction, perhaps 10-20 percent, of Arabs who go abroad for technical and scientific training fail to return home, either remaining in the host country or relocating in oil-rich Arab states where pay and facilities are better.

Because of their determination to replace expatriate technicians with natives at the earliest possible time, the oil exporter states have now begun to stress science and technical education in universities. However, the availability of technically *trainable* manpower, given the still primitive quality of primary and secondary education, severely limits the speed at which this goal can be accomplished. Saudi Arabia and Iraq in particular, where preuniversity education is rather rudimentary, are stressing basic educational programs that will support science expansion only in the long run.

Industry outside of petroleum has played a minimal role in sponsoring R&D in the Arab states, except in Egypt. A surprisingly small percentage of the available native scientists and engineers actually conduct research or work on development problems. In government, industry, and the military, technically trained people quickly become managers and cease before long to be technical.

Table 5 provides a comparative picture on the basis of available data. Egypt's sizable commitment to R&D is revealed by the high fraction of the labor force involved and by the 0.8 percent of GNP it devotes. The long history of trade connections with the West and early emergence of manufacturing (e.g., in cotton

Table 5
R&D EXPENDITURE IN SELECTED COUNTRIES, VARIOUS YEARS

Country	Year	Number of Scientists/ Engineers/Technicians Engaged in R&D Per 100,000 Population	R&D Expenditure as % of GNP	Average Annual Expenditure Per R&D Scientist or Engineer (U.S. $)	Per Capita Expenditure on R&D (U.S. $)
Arab Countries					
Algeria	1974	2.2	0.13	30,000	0.6
Egypt	1973	29.8	0.83	7,235	2.2
Iraq	1974	17.7	0.25	16,860	2.4
Jordan	1973	8.7	0.31	15,390	1.1
Kuwait	1973	20.2	0.01	17,100	0.8
Lebanon	1973	18.8	0.40	22,400	—
Sudan	1974	2.8	0.33	31,177	1.0
Tunisia	1972	20.2	0.30	10,900	1.1
Yemen A.R.	1975	1.8	0.25	35,267	0.3
Non-Arab Countries					
Federal Republic of Germany	1972		2.30	59,584	96.6
Japan	1973		2.00	18,312	54.4
Netherlands	1972		2.20	42,035	76.0
Norway	1972		1.30	36,081	46.9
United States	1973		2.50	55,800	139.0

SOURCE: UNESCO Document SC-76/CASTARAB/Ref. 1.

textiles) probably explain the Egyptian lead. Although Iraq demonstrated only a middling level of commitment by 1974, it has announced a new dedication to scientific development and has the resources to support its goal, including a fairly large population to draw from. Jordan is also making a determined effort in science and technology but is severely limited by a small economy and meager population. Figures on R&D expenditures are not available for Saudi Arabia or Syria. Saudi spending for R&D will probably approach the Iraqi pattern, given the expressed concern by Saudi officials and the large numbers of Saudi engineering students being sent abroad for training.

As to the future, Saudi Arabia and Iraq will probably begin to move upward, given their resources and stated commitments, although they have a long way to go in building infrastructure and achieving the cultural attitudes favorable to scientific endeavors. Egypt possesses the basis for a science-oriented society but lacks the physical resources for much future progress. Syria and Jordan appear too small and too poor for any appreciable improvement in the foreseeable future.

The countries of the Middle East, particularly those belonging to the "Arab Nation," pursue development according to individual conditions and priorities but also interact significantly with one another. Not only is there a degree of coordination—varying over time—in the foreign policies of the individual states, but they are linked by complex flows of resources across national boundaries. We explore some of these transactions below.

RESOURCE SHARING AMONG ARAB STATES

The capital to finance the social and economic modernization we have hypothesized to be a precursor to military effectiveness comes in the Arab world from one source, oil. Countries lacking their own export supplies depend on brother nations for assistance. Another sort of interstate dependency grows out of labor shortages and is remedied in part by labor exchanges among the Arab countries. The adequacy of the capital and labor flows is, in part, a function of the nature of inter-Arab politics.

Capital moves from the petroleum exporter states, Saudi Arabia, the Gulf states, Iraq, and Libya, to those with lesser natural endowments. Labor of all skill levels moves from "surplus" areas such as Egypt, the West Bank, and North Arabia to places where oil is fueling an indigenous economic boom. The state of tension, the prospects for true development, and the compatibility of leaders in the recipient states will all influence the future generosity of Arab donors and their hospitality to expatriate workers.

Capital

Of critical significance to the front-line economies will be the willingness of the oil-rich states to furnish large-scale assistance. The heavy spending of the 1973-1976 period—including the waging of the 1973 War—would have been infeasible without Saudi and Kuwaiti financial aid. Future aid levels will depend to some extent on the availability of surplus funds but even more on the interests, intentions, and fears of the surplus states.

The record since 1973, when oil prices started their steep ascent and large money reserves began accumulating in oil-producers' state coffers, exhibits several characteristics worthy of note. Reliable statistics on aid flows have been extremely difficult to assemble except in the most tentative fashion:

- Egypt has received the lion's share of Arab aid since 1973, some 80 percent, with Syria getting some 15 percent and Jordan 5 percent. Aid seems to be about evenly divided between direct military purposes and general budgetary and economic developmental assistance.
- Although aid pledges have been substantial, actual disbursements have lagged far behind. Transfers show no dramatic increases commensurate with increases in the monetary reserves of the oil-rich countries (with the probable exception of Kuwait). In fact, the percentage of Saudi GNP disbursed as aid to Arab states went down from 4.3 percent during 1968-1972 to 3.4 percent in 1974. (After the oil price increase of 1974, of course, higher absolute levels of Saudi aid will require smaller fractions of GNP. Global figures for Saudi aid since 1974 have not been available.)
- Much of the aid actually disbursed has been in the form of loans, not grants, and on terms that are not very liberal (e.g., they often bear a 5 percent interest rate and are repayable in seven to ten years).
- Aid suppliers have tied most of their assistance to specific projects and require rather strict fiscal accounting of how their money is being spent. Saudis, in particular, are concerned about the honesty and efficiency of the bureaucracies in the recipient states. Only in 1977 did they allow their loans to Egypt to go to direct budget support, and that as a result of the January 1977 riots and concern over the survival of Sadat's regime.
- The Saudis have been the main providers of outright grants for weapons procurement, with Egypt as the principal beneficiary. Here again, the recipient has little control over the funds themselves and little flexibility in their allocation, as the equipment is largely being purchased directly by the Saudis. However, there is some indication that the donors have a higher regard for the competence and integrity of military recipients.
- The two big spurts in aid since the October 1973 war—grants for recovery from war damages and restocking of military equipment in Egypt and Syria in the immediate aftermath of the war, and the $2 billion in loans to Egypt in February through May 1977—were direct responses to exceptional political circumstances. The first was a contribution to the war effort against Israel. The large 1977 commitments by the oil exporters helped salvage the domestic position of a regime more tolerable to the conservative states than the likely alternatives.

What emerges is a picture of careful, tightly controlled, parsimonious aid by the oil-rich states primarily aimed at stabilization of politically congenial regimes and dutiful participation in the anti-Israel struggle, and up to now only incidentally related to or occasioned by economic distress in the front-line states. If a comprehensive Arab-Israeli settlement materializes, aid for military purposes may decline very quickly. However, given the long-term economic problems affecting Egypt and the benefits to be derived from having a friendly, moderate government at the helm in politically radical Syria, aid levels are not likely to be reduced much over the

next decade. Less congenial regimes in Syria and Egypt would almost certainly find the Saudis more grudging.

Should the Middle East conflict continue unresolved, aid levels from all sources should be expected to rise somewhat as the confrontation heated up again, with the bulk of the increase coming from Saudi Arabia for military purposes. It should not be surprising to see Saudi aid figures double to over $4 billion per year if a slide toward a potential fifth war were to begin.

To sum up, the poor, front-line states can expect aid levels from the Arab oil producers to be affected by the future course of the Arab-Israeli conflict. A settlement will be reflected in a shift of assistance to the development sector. Increased Arab-Israeli tensions may produce an increase in aid but a shift of the bulk of it toward the military sector.

Traditionally, the flows of *private* capital ran from Kuwait to Iraq and from Saudi Arabia to Syria, but the takeovers of those countries by socialist governments have inhibited new investments. At the same time, private Gulf investments in Lebanon and Jordan have dropped off as a result of recent civil wars in those two states. As for Egypt, Gulf investors tend to feel that the "French" bureaucratic style in that country is an obstacle to business. They also complain that "one cannot telephone Cairo" because of the deterioration of the telecommunications system there.

To the extent capital availability influences military power, the prospects are that increased wealth will build up in the exporter states but that the front-line countries will receive appreciably more only if tensions escalate dramatically. According to this argument, Iraq and Saudi Arabia will flourish, but Egypt, Syria, and Jordan will do no more than hold their own.

Migrant Labor and Brain Drain

Labor exchanges among the Arab nations constitute the other side of the coin. Perhaps 2.5 million Arabs worked in countries other than their own even as early as 1970. As many as 1.5 million Egyptians—technicians, artisans, truck drivers, physicians, nurses, school teachers—work in Libya and to a lesser extent in Saudi Arabia and the Gulf states. Up to 250,000 Palestinians are employed throughout the Peninsula, as are Lebanese. The oil exporting economies are increasingly dependent on imported labor, although such a situation is a cause for some anxiety. There have been reports of labor unrest at Jubail in Saudi Arabia and at the Qatar steel works. Many of the smaller Gulf states now have a majority of expatriate workers. The continuation of high wages in oil producing states and the need for remittances (Egypt currently derives about $400 million per year from this source) in the labor exporting countries suggest a continuing flow, or at least make repatriation unlikely. But the problem of "brain drain" in Syria, Egypt and Jordan, and the labor importers' fears of being overwhelmed (responsible in part for the increasing encouragement to temporary East Asian workers), may yet result in inter-Arab agreements to control and regulate the labor flows.

The existing arrangements covering migrant workers are mostly bilateral and primarily deal with skilled and professional workers. Thus, teachers, trainers, doctors, nurses, etc. are provided from those Arab countries that can supply them. Other less formal systems of manpower transfers, based mostly on personal recruit-

ment and application, go on between Arab states as well. This is particularly true of construction workers and laborers.

In addition, of course, many Arab emigrants leave the Middle East for Western Europe and North America. Engineers, physicians, and businessmen—particularly from Jordan, Egypt, and Lebanon—flocked to the United States during the 1960s and early 1970s. The brain drain out of the Arab world seems to have moderated somewhat as opportunities have opened in the oil producing states and as governments have become more concerned to ensure that students sent abroad for study will return.

Supplies of skilled labor constitute critical inputs in the development process. All of the countries we have studied, except for Egypt, exhibit serious shortages in key skills. In Syria and Jordan the problem grows worse as labor continues to emigrate. In Saudi Arabia and the Gulf, the increasing proportion of expatriate labor causes the rulers to feel insecure and to consider limiting the numbers, thereby inhibiting their growth potential. Iraq, which seems to have decided to live largely within its own domestic labor means, finds itself unable to progress in many areas. Only Egypt has adequate supplies, at least on paper. But the quality of Egypt's labor, its allocation among sectors (especially industry vs. bureaucracy), and the increasing tendency for the best to leave imply manpower problems even in this "population surplus" economy. The shortages will more and more require government to choose between releasing skill supplies to the hungry civilian economy and continuing to hoard them in the military.

ATTITUDINAL AND CULTURAL TRAITS THAT IMPINGE ON MODERNIZATION PROSPECTS

Although the Middle East states under study vary substantially in the degree of modernization they have already attained, certain cultural attributes have important implications for current and future military competence. Any attempt at policy manipulation must contend with longstanding attitudinal predispositions. Religion, education, social organization, the state of economic development, and history combine to produce a set of attitudes that inhibit the emergence of technical sophistication in troops and modern management practices in military leadership. Rather than attempt to characterize the cultural position of each country on the basis of the traditional-Islamic versus the Western-industrial, we will discuss a set of modal attributes of the Middle East outlook, identifying the traits and attitudes relevant to military competence.

The description of culture and attitudes presented here emerged out of myriad conversations with American civilian and military people who have had sustained familiarity with the Middle East. We noted a remarkable consistency in opinion on the vestiges of cultural barriers to modernization. Impressions of our respondents came from field experience and not from exposure to the standard academic analyses of the regional personality such as Patai's *Arab Mind*[5] or Berque's *The Arabs*.[6] Each respondent cited numerous anecdotes to support the contentions made. Still,

[5] Scribner's, New York, 1975.

[6] Praeger, New York, 1964.

cultural generalizations are fraught with subjectivism and, particularly because our informants were Westerners, may include significant traces of ethnocentrism as well. We present this material because it seems to represent a fair consensus among knowledgeable and experienced observers, but we recognize regretfully that it may strike some readers as verging on stereotype.

Muslim religion stresses the unquestionable authority of scripture as revealed in the Koran, the unadulterated expression of God's word, transmitted through his prophet Mohammad. The teachings apply to political, social, and economic relations as well as to metaphysical matters. The resulting conformity, fatalism, and authoritarianism contrast with the emphasis accorded individualism and self-determination in, say, American or Australian society. Acceptance, obedience, and loyalty figure prominently. Although such traits are valuable in instilling discipline, they may work against the flexible and adaptive behavior required to successfully prosecute the sorts of military engagements likely in the region, especially in opposition to Israel.

The education system, still incompletely secularized at the preuniversity level, reinforces these culturally instilled habits and perspectives. Rote memorization continues to dominate learning; problem-solving through generalization, trial-and-error techniques, and reasoning by analogy are exceptions to the rule. Religion, language, and culture (rather than mathematics, science, and social studies) remain the emphasis in primary schools and, in many states, even in secondary schools.

Low per capita incomes and lags in economic development mean that children grow up with little exposure to the mechanical artifacts of society. In well-to-do families where these appurtenances of industrial society may be common, the ingrained disdain for manual labor may militate against the development of mechanical aptitudes.

Prejudice against hands-on activities has other negative consequences. Because clerical, mercantile, and administrative functions command higher prestige in Muslim societies, even those who have received technical training—engineers, chemists, journeymen mechanics—seek departure from the field, the lab, or the shop to become managers. The shortage of middle-level managers in developing economies accelerates the drain. The result is often a waste of much of the investment inherent in the training.

The inertia that emerges out of these underlying religious and educational traditions finds reinforcement in another aspect of Middle East culture. The importance of "face" and the associated use of shame as a negative sanction works against the adoption of unconventional methods. Outcomes that are unfortunate are regarded as personal failures, whereas in other cultural contexts they would be regarded as risks worth taking in the deliberate search for novel solutions. In societies that use guilt, a demonstration of worthy motivation may excuse lack of success; in those that use shame, often associated with a favoring of ends over means, almost nothing can justify a mistake.

The authoritarian element in Muslim society further predisposes caution. Leaders' decisions go unchallenged simply because they occupy elevated positions in the hierarchy. The social distance between superiors and subordinates makes the former distrustful and contemptuous toward initiative in the lower ranks. Although in some Middle East states, women, minorities, and even foreigners have begun to enjoy greater access to positions of responsibility, chauvinism also continues to exact its toll by wasting talent.

Finally, the political instability of governing regimes inhibits sharing of authority. Power independently exercised may be regarded as an invigorating influence in many nations, but in many others it is threatening to existing regimes. The Arab countries being among the latter, the leadership tends to hoard power. Aristocratic vestiges may have waned, but political loyalty often replaces birth as a criterion for assignment and promotion. The ascriptive system is thus replaced by one based on fidelity rather than merit. A leader appoints the most faithful candidate who frequently has ties to the same family, town, or sect as the governing group.

In short, fear of failure, authoritarian attitudes, and political instability all contribute to organizational systems in which vast numbers of decisions are routinely bucked up to scant numbers of top leaders. As a result, decisionmakers lack the information required to identify and select what, by Western standards, would be the logically sensible options; and so many decisions are imposed on so few decisionmakers that responses are delayed. To economize energy and expedite action, elaborate but brittle plans define "solutions" to problems. These plans are functional only so long as the external world behaves according to a fixed script; against a resourceful adversary or even recalcitrant nature, strict adherence to the blueprint may lead to failure and defeat. Resourcefulness in military behavior is stressed in precisely those units—the Palestinian terrorist-commando outfits—that are not tied to established and therefore centralized governmental authority.

Most observers remark a withering away of the attitudes and outlooks that impede modernization as a result of the very process of modernization itself. As urbanization and industrialization take hold, fear of experiment, xenophobia, fatalism, social rigidity, and disdain for the manual appear more and more dysfunctional. Violations of tradition—in expression or behavior—provoke weaker social sanctions and finally become the new norm.

Individual attitudes alter more rapidly than do a culture's characteristic organizational forms. A society will begin to produce individuals who can solve technical problems, for example, before it evolves the organizations necessary to accommodate and reward such talents. The evolution of the organizations requires the purposive coalescing of like-minded people, socially a much more difficult task than providing education or even inculcating new attitudes. Thus, the appearance of administrative structures that automatically and impersonally define problems, lay out alternative solutions, test options for feasibility, schedule the pursuit of the adopted strategy, and reward participants on the basis of results may substantially lag the availability of competencies in the populace.

The attempt to duplicate organizational forms that appear successful in admired foreign contexts may at times actually constitute an impediment to true managerial effectiveness. The Arab penchant for elaborate and intricately prespecified plans of action may lead to sacrifice of flexibility and spontaneity. The key, it appears, lies in sufficient confidence by the leadership in both the loyalty and capability of subordinates that the appropriate delegation of authority may take place. Given this trust at the top, plant managers, office chiefs, and field commanders will grow accustomed to making the responsible but imaginative decisions required in fluid situations.

On net, we see in the Middle East a group of societies undergoing change. Outlooks and attitudes characteristic of the preindustrial stage linger on and continue to affect the pace of modernization but are indeed fading along with develop-

ment. Change at the individual level outstrips reform at the organizational level. But the recognition of weaknesses and the experience of 30 years of intermittent warfare will inevitably speed the process of adaptation in the military forces. It is to specifically military developments that we turn next.

IV. MILITARY MODERNIZATION IN THE MIDDLE EAST

As we have seen above, a host of factors come together with the human variables to influence the effectiveness with which a given society will exploit its military forces. The nature of the threat, the strategic objectives, the weapons available, terrain, and climate of course form the background against which the human factor is played out. And, for purposes of analysis, the human factor requires subdivision into the mental and physical characteristics of troops, qualities of leadership in officers, and organizational structures appropriate to the accomplishment of military missions. Some of the human factors are amenable to change through policy decisions, others are largely autonomous in their gradual evolution. We aim to provide an abbreviated summary of findings as to the directions of change in a list of what we have come to see as the critical variables. This synopsis constitutes our attempt at assessment of the various hypotheses introduced earlier in the report.

AUTONOMOUS VARIABLES

Population size confers obvious advantages. The determinants of the size of the required military force are largely exogenous and stem from the strategic situation facing the country. Other things equal, populous countries can more easily find the trainable manpower required in their military forces, assuming a fairly equal distribution of native abilities in each country. Civilian human capital programs—nutrition, health, education, training—will naturally enhance the effective supply.

In this connection, we explore here some national indicators of military effort in relation to each economy and labor force. The states of the region vary appreciably in commitment of national resources toward security ends. As shown in Table 6 it is generally the oil-rich states—Saudi Arabia and Iran—and the confrontation states—Egypt, Jordan, and Syria—that devote large fractions of their national products; none, however, comes close to Israel's commitment. Iraq, so far, lags considerably in the fraction of GNP absorbed by the military, as does Turkey, which has neither the excess budgetary resources nor the immediate security problem.

A somewhat different picture emerges from the per capita statistics. Wealthy Saudi Arabia, to a lesser extent Iran, and beleagured Israel stand out. Populous states such as Egypt and particularly Turkey score low. The requirements of confrontation for Syria and Jordan and a favorable ratio between foreign exchange and population for Iraq tend to push them to the intermediate rank.

Table 6 indicates relationships between national populations and the size of the various military forces. By and large, the bigger the fraction absorbed by the military, the more intense will be the competition between the sectors. Clearly, however, low levels of demand for raw unskilled labor in the domestic economy (as in Turkey) will reduce the social cost of mass conscription. Moreover, the average level of skill in the population affects the results of the competition. In a sense then, Israel, where skills are highest, may be more capable of bearing the enormous burden of her military than Saudi Arabia, whose burden is small but whose skill

Table 6
MILITARY EXPENDITURES IN RELATION TO GNP AND POPULATION IN SELECTED MIDDLE EASTERN COUNTRIES, 1978

Country	Military Expenditures (millions/dollars)	Military Expenditures as a Percent of GNP	Military Expenditures Per Capita (dollars)[a]
Egypt	2.8	21	70
Iran	9.9	14	280
Iraq	1.7	11	136
Jordan	0.3	23	100
Saudi Arabia	9.6	17	1215
Syria	1.1	17	151
Turkey	1.7	4	39
Israel	3.3	30	892

SOURCE: The International Institute for Strategic Studies, *The Military Balance*, 1978-1979. These figures appeared to us more reliable than those presented by the U.S. Arms Control and Disarmament Agency in *World Military Expenditures and Arms Transfers 1967-1976*. They are, for example, much closer to figures reported in classified intelligence sources.

[a]Based on CIA population estimates, *National Basic Intelligence Factbook*, 1978.

level is also low. Egypt, Iran, and Turkey employ considerably smaller fractions of their labor forces to meet military needs.

The advantages of a large population base in relation to the size of the armed forces are illustrated by Table 7. For all of the populous states—Egypt, Iran, and Turkey—the military absorbs about 6 percent of the relevant population and about 10 percent of the population "fit" for service. These are also the states, aside from Israel, where the armed forces encounter the least relative difficulty in meeting skill needs. Saudi Arabia attempts no more than the "Big Three" in percentage terms, but the backwardness of her population makes it substantially more difficult to secure an effective military. Jordan and Iraq appear not too dissimilar in aspiration and Syria seems to try the hardest of all, exclusive of Israel. By deduction, what we have discovered about skill shortages in Jordan—that, for example, supplies of readily trainable men are soon exhausted—may apply as well to Iraq and even more pronouncedly to Syria. Israel plays in an entirely different league in terms of population skill levels so that even if it devotes the highest fraction of manpower to its military forces, it is able to attain the most in average military competence. Nonetheless, the cost of the standing army in economic product forgone is bound to be heavy there, as suggested in Table 6.

Industrialization and attendant urbanization move society along paths that widen the option for building military power. Not only do physical resources for military aggrandizement become more available but the entry into technological culture usually prepares the citizenry for participation in collective undertakings in which a modern outlook confers great advantages. Although it is undoubtedly true that the sense of collective purpose (notably the Israeli concern with national survival) enhances effectiveness, it is also the case that warfare has changed so dramatically that the general concomitants of urban industrial existence—the ability to work in organized teams with advanced equipment—outweigh the martially useful qualities generated in nomadic or rural societies—fierce loyalties, personal bravery.

Table 7
COMPARISON OF POPULATION AND MILITARY FORCES FOR SELECTED MIDDLE EASTERN COUNTRIES, 1978

Country	1978 Population (estimated, in millions)	Relevant Population (males 15-49)	Number Considered "Fit" to Serve[a]	"Fit" Population Relevant Population	Number of Males Reaching Military Age Annually (eligible military age)	Number in Military Service[b]	Percent of Relevant Population in Military Service	Percent of "Fit" Population in Military Service
Egypt	39.9	8.59M	5.60M	.65	384,000 (20)	511,800	6	9
Iran	35.3	8.08M	4.79M	.59	350,000 (20)	524,500	7	11
Iraq	12.5	2.64M	1.48M	.56	118,000 (18)	221,800	8	15
Jordan	3.0	624K	444K	.71	32,000 (18)	69,300	11	16
Saudi Arabia	7.9[c]	1.81M	1.02M	.56	66,000 (18)	87,400	5	9
Syria	8.1	1.82M	1.02M	.56	96,000 (19)	262,500	14	26
Turkey	43.1	10.67M	6.28M	.59	461,000 (20)	642,000	6	10
Israel	3.7	760K[d]	655K[d]	.86	60,000[d] (18)	199,600	26	31

SOURCE: Central Intelligence Agency, *National Basic Intelligence Factbook*, 1978.

[a] "Fit" is defined as admissible for service in peacetime on physical and mental criteria.

[b] Includes National Guard equivalent units.

[c] Figure is in dispute even among intelligence sources; an estimate around 6-6.5M total is the consensus.

[d] Figures for Israel include *females* as well as males.

In our review of comparative rates of national military modernization, the relative positions of Egypt and Iran on the one hand, and Saudi Arabia and Syria on the other, seem quite informative. Noting that each pair contains *both* rich and poor states, the former have demonstrated a superior capacity to translate elements of modernity from the economic sphere into the military. The choice made by Saudi Arabia and Syria, modernization of societies *through* the military vehicle, may have costs in strictly military terms. Turkey represents an interesting case in point. The Turkish attempt to modernize its social structure through military service appears to have degraded military effectiveness. To build a modern military in a traditional society may be a good development strategy; it is unlikely to win wars against a thoroughly modern opponent.

Given contemporary sources for technology and advanced economic organization, modernization will probably be accompanied by increased exposure to the West. When the Western influence extends into the military, to the supply of arms and the training of men, it seems to confer an additional advantage. The case of Jordan is illustrative. Jordan's small size and vulnerable strategic situation have affected its ability to swing substantial weight in past Arab-Israeli engagements. But Israelis, almost unanimously, rank Jordanians as man-for-man their most dangerous opponents in the air and on the ground. Most attribute the Jordanian edge to their long association with the British as military advisors and trainers. The contrast between the results of the British influence in Jordan and the Soviet influence in Egypt (pre-1973) provides further confirmation of the thesis.

Urban industrial societies generally have higher levels of per capita income for the mass of the population. For armies, general affluence confers its advantages through the physical stamina and mental competence of the troops. Among the countries we have examined, differentials in standards of living are not at present very great. Impressive statistics on per capita income in the oil-rich states mask an extreme maldistribution often characteristic of the early stages of economic development when affluence has not yet trickled down to the masses.

But rates of economic growth do differ appreciably across the selected countries. Those with expanding economies find it increasingly difficult to attract and retain needed talents in the military sector against the enticement of high wages and opportunities for advancement in civilian life. Iran and Saudi Arabia are examples. But even in the slow-growth and no-growth economies, competition for personnel enters through the lure of emigration. Hundreds of thousands of young Egyptians, Jordanians, and Syrians work in the Gulf states and Libya where oil export proceeds fuel a continuing economic boom.

Stable regimes can wield military power more effectively, not because they necessarily have superior supplies of human capital but because they can afford to organize people more efficiently. They are secure enough to attempt to delegate authority to its most appropriate level, having less fear that independent nuclei of power will threaten the existing structure. Delegation appears to be a prerequisite to the establishment of flexible and adaptive command structures.

Over and over we were struck by the critical contribution of dencentralized decisionmaking to the successful prosecution of war in the region. The 1973 War, on both the Sinai and Golan fronts, illustrated how hypercentralized military commands on the Arab side found it difficult to respond to unanticipated opportunities and threats: The Syrians ignored a possible opportunity to advance beyond the

Golan Heights and into the Galilee Valley in the first few days of the campaign; the Egyptian canal crossing achieved such surprise as to make possible the occupation of the Mitla Pass and Abu Rudeis but the opportunity was not pursued; it took inordinate time for the Egyptian high command to react to the Israeli counterattack on the west bank of the Suez. Anecdotal evidence as to the superiority of Egyptian field commanders relative to the Syrians leads us to surmise that a portion of the edge in organizational adaptability displayed by the Egyptian military (compared with the Syrian) may be attributable to the regime stability factor.

Some have argued that the fear of insurrection directly affects training practices as well. Without live ammunition and combined force operations, the realism of exercises is much reduced and the preparation of the forces thereby diminished. But fearful leaderships seem reluctant to disperse the resources and to permit the lateral cooperation necessary to organize these sorts of exercises. The superior internal security situation in Egypt, compared, say, with that in Syria and Iraq, should in days to come begin to translate into better training and then greater potential battlefield responsiveness.

Regime insecurity has additional implications. Where loyalty to the existing government is an issue, the leadership will naturally stress faithfulness rather than competence in making assignment and promotion decisions. The Jordanians regularly favor Bedouins over Palestinians, the most educated and progressive component of the population, in sensitive military appointments. Evidence of the loyalty criterion is also seen in the dominance of Alawites in key Syrian command positions and a favoring of leaders orginating in the town of Tikrit in the Iraqi forces. As an example of the consequences, many observers allege a sharply negative relation between rank and capability in the Syrian officer corps, although they perceive no such pattern among the Egyptians. Whether the high quality junior officers observed in the Syrian forces in 1973 will be permitted to advance up the ranks and, if so, whether they will then be coopted (and defanged) by the reigning establishment remains to be seen.

Most commentators agree that aside from the "loyalty test," barriers to advancement based on ethnicity or social status have receded in all of the Arab societies as democratic and pluralistic ideas gain acceptance. Perhaps the clearest and most costly—in efficiency terms—of the remaining barriers affect women, particularly in the most traditional societies such as Saudi Arabia. Even with the severe labor shortages in the Kingdom, women hardly participate in the civilian economy, let alone in the military forces. Jordan, Iran, and Egypt have much more readily accepted women in clerical and technical positions, even in the military, although a strong reaction by traditional elements is already apparent.

The military, of course, must compete with the civilian economy for the society's available talent. Given the level of effectiveness in conscription policy, the higher the prestige and the more attractive the conditions of the military calling, the easier the attainment of manpower goals. Turkey, where the warrior tradition reigns and the military career confers high prestige, meets its manpower objectives most successfully among the countries surveyed. Conscript quotas are easily met too because the living standards and the education and training opportunities compare favorably with civilian life. Military careers have lower relative prestige in Saudi Arabia and score lower still in Iran, with obvious negative implications for recruitment in those countries.

In the course of our study, we found that commentators consistently reflected on the cultural characteristics that affect the trainability and performance of Middle Easterners. These cultural characteristics appear to suffuse the entire weapons absorption and military modernization process, and we summarize comments on some of these traits here.

These characteristics plus an accompanying disregard for tools and measures discussed in previous sections mainly affect maintenance operations, as in Iran, where maintenance is regarded as a dirty word. Iranians tend to perform quite well at "clean" electronics work.

In Saudi Arabia a reinforcing belief holds that contractors have been hired to do the dirty work, but Jordan and Egypt, owing to their different cultural backgrounds and more vocationally oriented educational systems, do not hold that belief to nearly the same extent. In the Middle East (as in much of the rest of the world) piloting airplanes is regarded as respectable, but driving tanks is dirty. Therefore, higher status people are attracted to the air forces.

Progress toward a more functional work ethic comes in fits and starts when the proper incentives are instituted. After exposure to U.S. military training, Iranian and Saudi students generally show that they can develop mechanical aptitudes and perform adequately, but they sometimes relapse upon return to operational assignments. The Turkish experience suggests migrant workers who return from Western Europe may often absorb and subsequently use more efficient business practices. They may also create new demands for better public education and vocational training in the home country. Turkish involvement in NATO may have had similar effects in the specifically military sphere, as a result of some standardization in training practices, the participation in joint exercises, exposure to high standards of performance, etc.

Knowledge acquisition comes through drill, not analysis. Rote learning leads to mastery of routine tasks but does not develop the ability to see cause-effect and ends-means relationships. This outlook suffices for systems in which operation and maintenance is based on repetitive steps, as in the TOW anti-tank system. But memorizing set procedures does not instill flexibility and ingenuity or the ability to adjust to unforeseen contingencies. One wonders whether the Arabs, for example, have absorbed the implications of mistakes made in the October War to the extent that Israelis have learned from their own weaknesses.

In Middle Eastern cultures, responsiblity tends to be treated as a shared social phenomenon rather than as something pertaining strictly to the individual. Concepts of right and wrong depend less on individual determination and more on what is deemed right or wrong by the world surrounding the individual—producing people who are sensitive and subject to public shame but feel a lesser sense of personal guilt.

Answering to society for all deeds creates pressures for officers and men to appear blameless, by keeping and saving "face," to escape censure. Face thus becomes an extremely important element of personal motivation and social interactions because it reflects the individual's worth and dignity. Keeping face often results in formal showmanship, and saving face requires excuses for failures and shortcomings and leads to shifting blame. The concern for face affects the predisposition to both offer and accept criticism.

The ability to put on a good show—the affixing of decals to the fuselage—may appear more important as a measure of success than a high operational readiness

rate, the practical importance of which may even be downplayed. The imperatives of serving the group and keeping face also have pronounced effects on the classroom performance of military trainees. Students avoid showing ignorance by not asking questions. Instructors avoid provoking shame by not posing questions. Cheating carries little stigma and may, in fact, be seen as a way for students to help each other and to serve group goals. Refusing to help a colleague is thought dishonorable. U.S. instructors have had to take considerable care to design programs that will accommodate cultural differences. Otherwise, there would be little give and take in the classroom and poorer students would not receive remedial training.

The pervasiveness of what are often called "punishment" cultures in the Middle East also has military implications. For example, in Iran, if a civilian or military technician made an error, he could lose pay and risk incarceration or corporal punishment. This incentive system motivates some typical behavior patterns ranging from general inertia to the falsification of reports. In tactical flying, for example, concern for the safety of the aircraft often leads to very conservative training. In maintenance, fear of losing or damaging equipment means conservative testing and practicing. In Iran, at least, the harshness of the punishment culture had recently diminished. Some Western management techniques—discussion meetings that help identify problems without trying to cover up failures, devices to retrain mechanics who err—were being adopted in the military. Lesser adaptation is seen in Saudi Arabia.

Rigid hierarchy, centralization of command, and prescribed responsibilities mark Middle Eastern authority patterns. These translate into a penchant for staying in conventional channels in military operations. At working levels, skills and duties become highly compartmentalized and isolated. One's power base often depends upon, and is reflected by, hoarding of materials, parts, and personnel. Disgorging a hoard may require multiple signatures and forms so as to disperse responsibility.

The ideals of centralization cause middle-level personnel to reject decisionmaking responsiblity and to pass even small matters up to higher commanders who then become burdened with decisions on issues about which they lack necessary information. High-level authorities are expected to behave in a fairly rigid manner. Apparent obedience to orders is automatic even when the command is not fulfillable. The result of these conditions is to diminish the incentives and opportunities for showing innovation and flexibility. In pilot training, Middle Eastern students tend to place inordinate reliance on the Instructor Pilot, so that they frequently fail to learn the systems and procedures thoroughly. This inhibits the development of flexibility in dealing with unexpected events.

Cultural constraints relating to local ideas of authority and responsibility are reflected throughout the processes of technology absorption. For example, the Iranians had planned to purchase the most sophisticated C^3 technology in the world, but were installing only the vertical linkages upward to the Shah, and not the horizontal field linkages. The Arabs—except for the Jordanians—have had even more noticeable difficulties in adopting modern C^3 technology, again partly for cultural reasons: the reluctance to share resources, the concern to protect oneself from responsibility for failures, the lack of faith by superiors in the competence of subordinates. The resulting inflexibility degrades training exercises and, ultimately, adaptability on the battlefield.

CIVILIAN POLICY VARIABLES

Human capital building programs—basic and university education, technical and vocational training, public health, medical care, and nutritional improvements —obviously enhance the quality of the population base from which the military recruits its force. Some Israeli commentators perceived significant improvement in health and literacy among Egyptian prisoners captured in 1973 over 1967. However, spending on such programs comes out of the same national budget that finances direct military expenditures, and the civilian program inevitably benefits people who do not enter the military. A dedicated warrior state could conceivably concentrate its human capital improvement efforts exclusively on its soldiers, at least in the short run. All of the states we studied have adopted a more generous approach and have generally had comprehensive social programs. Those with the heaviest defense burden, such as Syria, have obviously had to make the most sacrifices on the social front.

Table 7 shows the 1978 total population estimates for the states surveyed together with the size of the relevant population, the "fit" population, and the military forces. An indication of the general extent and success of human capital programs can be surmised from the column indicating the fraction of the population aged 15-49 deemed fit for military service. Although Israel leads the others at 86 percent, Jordan stands out among the predominantly Muslim states at 71 percent, and Egypt follows at 65 percent. All of the others cluster between 55 and 60 percent.

MILITARY POLICY VARIABLES

As we have discussed earlier, and as Tables 6 and 7 bear out, countries that field large armed forces out of small or poorly prepared population bases encounter the most difficulties in meeting military manpower requirements, explaining the comparative difficulties noted in Syria, Jordan, and Saudi Arabia.

Recruitment methods vary widely among the states. Some, such as Egypt and Syria, conscript; others, such as Saudi Arabia, rely on volunteers. The choice depends on tradition, politics, and military needs. In some states—Egypt, for example —conscription can tap scarce skill supplies. In others, selectivity through "hiring" may be advisable, at least given the somewhat negative experience with conscription in Turkey. Retention policies also vary. The hitch lasts from 20 months to three years for enlisted men in each country. The period adopted represents a choice on the tradeoff function between current capability, which is best attained through a standing professional force with years of experience, and mobilization potential, which is heightened by the processing of larger numbers of young men serving necessarily shorter hitches. The latter option will also appeal to Turkey, which sees its army as a modernizing and socializing vehicle for the larger society.

Generally, expertise in assignment—the matching of aptitudes and skills with positions—is quite underdeveloped in Middle Eastern militaries. Diagnosis and remediation receive short shrift. Political loyalties continue to weigh heavily in promotion decisions. Assignment problems emerge not only out of inexperience with the principles of personnel management but as a result as well of the often observed inclination to strip the best human resources from the generality of units

so as to man the elite forces or the most recently acquired weapon system. Favoring SAM and anti-tank units in 1973 seems to have led to certain advantages for the Arabs, however. Iran seemed to have made the most progress in planning for force balance, but even there the priority unit syndrome produces adverse spillovers on personnel capabilities in the general run of units.

We have pointed out the inefficiences inherent in the maintenance of ethnic, sex, and class barriers to participation. The military forces of the states studied vary substantially in their openness to pluralism because the political price necessary to gain the advantages of wider access differs among them. The Iraqis distrust the Kurds, Jordanians restrict the Palestinians, Syrians discriminate against Shiites, each operating out of motives of regime security and political patronage. Integration of women violates deep-seated values in Muslim society of which the Saudi rulers seem most observant. Even in neighboring Iran, the Shah's attempt to break with traditional sexual segregation evoked strong reactions.

Although our evidence is sketchy, class barriers have apparently been the earliest to fall, particularly in the ostensibly socialist states of Iraq, Syria, and Egypt. But in Egypt, particularly, we have noted a tendency—reflecting broader social values—to permit paper credentials to signify as weightily as demonstrated competence. The importance of merit rather than background or loyalty may differ by service within a given country. In Jordan, for example, the air force appears superior to the ground forces in its readiness to assign and promote officers on the basis of competence alone.

The Middle Eastern concern for face, also discussed earlier, adds complications in the development of rationalized personnel systems. Criticism evokes shame and becomes muted out of a reluctance to embarrass fellow soldiers. Add this to notions of shared rather than individual responsibility, and the result often is a failure to demote or discharge the inept. These problems show up most prominently at middle management levels. The Iranians appeared to have diagnosed their difficulties and were making some progress in dealing with them by means of training reforms and debriefing sessions.

All of the states have experimented with the use of outsiders for the performance of certain specialized tasks. The Saudi military employed vast numbers of foreigners from South Asia, East Asia and the West. The Iranians tapped foreign sources to meet skilled labor shortages and also developed the *homofar* system in which fairly high wages were paid to indigenous civilians with scarce skills on long-term contract to the military. The homofar concept offers attractive advantages to those other forces in the region in which acute civilian skill shortages do not preclude its use (e.g., Egypt, perhaps Syria and Iraq). The idea, however, seems not to have spread.

The employment of outside personnel certainly adds to immediate capability and most likely expedites the enhancement of indigenous military skills through OJT. But such dependence also carries costs aside from the obvious ones inherent in higher compensation and, in the case of expatriates, the depletion of foreign exchange reserves. Civilian workers are generally less subject to military control and discipline than are their national military counterparts. When the outsiders are also expatriates who owe primary allegiance to some third power, the ability to make war on any sustained basis will be affected by the acquiescence if not approval of that third power.

Substitution of capital appears as one solution for labor shortages. Black box replacement in place of periodic maintenance is a concrete manifestation. As we have argued, however, the substitution may simply escalate skill requirements to a higher level. The instruments that diagnose the black boxes require maintenance. There is increased dependence on a sophisticated system to supply the black boxes where and when needed. Because skill shortages are even more severe at these levels, the alleged "capital substitution" solution may prove ephemeral.

Although necessary to prepare the forces for action, training is, as we have discussed in earlier sections, expensive in several senses: It uses resources and it degrades immediate response capabilities. The poverty of many of the countries in the region constrains training by limiting supplies of parts and expendables. Egypt and Jordan come prominently to mind.

The goal of catching up with the Israelis in proficiency drives the Arab forces to train more intensively. The improved Arab performance, particularly in anti-aircraft and anti-tank units, demonstrated in 1973, testifies to the payoff from training. A side cost often intrudes, however. The better the training in technical subjects, the harder it is to retain the resulting electronics specialist or engine mechanic in the military force, given his alternative pay in the civilian economy. This problem has been most severe in Iran, Saudi Arabia, and Jordan where the lure is emigration, but it is felt even in Turkey. The United States and Israel are not immune to this problem either.

Training often works best when the trainee is removed from the inhibitions of his accustomed sociocultural milieu. Acceptance of individual responsibility and criticism, innovative behavior, esteem for manual endeavors, and willingness to work long hours may be more easily inculcated in settings where these traits are approved and rewarded. Middle Eastern students often return from training stints in the United States fired with new attitudes and work styles. The use of bicultural liaison officers, assigned responsibility for discipline and behavior, who accompany their training contingents, had come to be seen by Iran as an effective device for reinforcing the positive effects. The Saudis have recently installed similar procedures. Always present, however, is the danger of reversion to traditional behavior following the return to the home country.

In none of the countries studied did we encounter any *absolute* barriers to training operators and logistics support personnel for sophisticated weapons. Even in Saudi Arabia, where manpower shortages and cultural inhibitions seem most severe, training takes. But we also found that it may require twice as long to produce a Saudi pilot, mechanic, or supply clerk with U.S. proficiency standards. In the other countries where the U.S. trains military personnel—Iran, Jordan, Turkey—the training period exceeds U.S. specifications but by lesser amounts.

Deriving the most benefits from practice requires that exercises be carried out with a large element of realism. The Egyptian predisposition for thorough planning and intensive training appears to have yielded impressive returns during the canal crossing that opened the 1973 War. Use of live ammunition, arrangements for joint operations—for example, air-armor-infantry—and the incorporation of uncertainty and fluidity to the mock battle situation best prepares troops and commanders for the test of war. But certain background factors in the Middle East militate against such devices. Ammunition is expensive. Inter-unit horizontal links are undeveloped as a consequence both of tradition and regime insecurity. The preparation of a flexible response capability goes against the Arab preference for well-specified and

well-rehearsed plans. The yield derived from force exercises is thus diminished even *when* they occur. Without practice, skills acquired in training may atrophy to the point where the system simply loses its effectiveness.

Supply systems provide ample illustration of organizations where traditional patterns of authority and responsibility have constrained efficient performance. The reluctance to release accumulated hoards, the insistence on face-to-face transactions, the fascination with forms and stamps, and the disposition to seek higher level approval for trivial decisions means, for example, that a parts inventory may remain in excess in one location while equipment is grounded for want of the same item at a nearby base. These difficulties appeared even in Iran where progress in logistics rationalization had moved faster. Malperformance is even more widespread in Saudi Arabia (but individual parts inventories there are larger).

Basic reforms in managerial style must precede significant progress in what we have labeled macro-level competence. For the Arab states that have fought Israel, failures in responsiveness and adaptability have been noted repeatedly. Even in 1973 the Egyptian and Syrian forces displayed rigid adherence to prespecified plans and overcentralized command structures. Armored attacks, for example, were organized in textbook fashion with little attention to terrain or enemy responses. Lateral coordination was weak, and central HQ quickly became overloaded with information and slow to respond. Although some attempts at reform are underway, progress in this area is difficult and time-consuming. Other heretofore second-line states such as Saudi Arabia and Iraq have neither Syria's experience of past conflict to drive the lessons home nor the state of social development characteristic of Egypt and Jordan.

Iran had given some indication of rapid development in military management capability according to U.S. observers. Problems in evaluating Iranian progress stem from the paucity of tests for that system. Having fought no serious engagements against worthy adversaries, Iran's true abilities in this regard remained mostly a mystery. The Turks, with a long history of military relations with the West, gave a good account of themselves against the Greeks in Cyprus; but even they experienced difficulties in organizing the campaign.

CONCLUSIONS

In the medium term, the continuation of economic and social development and programs that increase the quality of a country's human capital will, in turn, enhance its military potential. Few states, perhaps, will opt deliberately to slow down the rate of economic growth expressly to ease recruiting problems. But given the supply of available manpower and an exogenously determined force size goal, policy choices represent alternative routes on the way to improved military effectiveness. There *is* a production function for military effectiveness, and its arguments include human resources, time, and perseverence. The primitive state of existing theory and the scantiness of data have prevented our research from estimating the size of the payoffs to be expected from personnel policies versus training versus exercises versus organizational reforms at functional and command levels. We have, we believe, identified the critical policy choices for the modernizing military. We reiterate the importance of the obdurate attitudinal variables that will impede the course of improvement associated with any change in strategy.

V. NET ASSESSMENT OF THE MILITARY BALANCE IN THE MIDDLE EAST

THE RELATIONSHIP BETWEEN MODERNIZATION AND THE MILITARY BALANCE

The unequal level of military modernization in different states affects their relative abilities to organize, maintain, operate, and obtain the greatest combat usefulness from given sets of equipment. Differences in organizational and managerial effectiveness, social and cultural milieu, manpower competence, combat experience, and military leadership greatly influence how effectively various systems are adapted to the particular requirements of different states. Indeed, it can be argued that although differences in the "human factor" are inherently more difficult to measure and quantify than differences in equipment, competence factors have historically had a *greater* effect on combat outcomes than have differences in weapons hardware.

Nowhere has this been more evident than in the Arab-Israeli wars. In 1967, the Israelis were outnumbered by more than 2:1 in combat aircraft and almost 3:1 in tanks, yet according to public reports they achieved an air combat kill ratio of 20:1 and a tank kill ratio of better than 7:1. In 1973, outnumbered again by 2.5:1 in both combat aircraft and tanks, the Israelis achieved favorable kill ratios of 40:1 in dogfights and 2:1 in tank kills. Some of these disparities are explained by differences in the performance characteristics of the equipment and some may be explainable by differences in casualty rates traditionally experienced between attacking and defending forces (particularly the tank-kill ratio), but these factors alone cannot explain the greater part of the outcomes. Indeed, on some characteristics, such as unilateral advantages in night fighting equipment in 1973, the qualitative edge in hardware favored the Arabs. Observers agree that only by bringing in the human competence differential can the Israeli margin of superiority be explained and that individual and collective excellence has been the keystone of the favorable military balance enabling Israel to tolerate greatly unequal force ratios.

It follows that improvements in the ability of the Arabs to use different equipment effectively could, in principle, more greatly affect the military balance than mere improvements in the quantities or qualities of equipment inventories themselves. In theory, if the Arabs could close the manpower and organizational competence gap or introduce new systems whose simplicity of operations reduced the importance of the gap, they might decisively improve the military balance. The modernization issue is therefore at the very center of efforts to assess the future Arab-Israeli military balance.

Differences in the levels of modernization among the states we have examined in the Middle East are probably not as wide as in the cases of the other military balances of the region, but there are some disparities. Egypt has a significant advantage over Libya, and Iraq has considerably greater combat experience than Kuwait and Saudi Arabia. Although Iran lacks the combat experience of Iraq, it appears to be at a higher level of modernization, and the gap appears to be widening. Iran had seemed much further down the road of modernization than Kuwait

or Saudi Arabia.[1] Finally, the Syrian-Iraqi balance is probably one of fairly equal levels of military effectiveness, although the advantages conferred on Syria as a result of more intensive war experience could tip the balance. Detailed comparisons in these cases are more difficult, as most of the recent combat experience of the region has involved opposed forces of Israel and the Arabs, and therefore most of the data points apply to this particular balance. Indeed, differences among the Arabs must be inferred from their unequal performance against Israel.

TIME TRENDS IN MODERNIZATION

When trends in modernization are related to the *future* military balance, it is important to recognize that not every increment of modernization by one side necessarily leads to a narrowing of the manpower and organizational competence differential and an improvement of the military balance in its favor. Conceivably we could see the Arab-Israeli gap widening rather than narrowing, in spite of Arab successes in modernization, when we examine the elements of the modernity gap more closely.

First, the level of modernization, as it relates to military competence, is a relative measure, and improvements on one side must be related to improvements on the other. It is sometimes asserted that the Israelis are already close to 100 percent of the theoretically attainable "perfect" operation of military systems, whereas the Arabs have been operating at only 25 or 50 percent effectiveness, and that therefore improvements on the Arab side are bound to narrow the gap. But individual and organizational competence are not "perfectible". As in competitive sport, there is always the possibility of improvement, and Israeli improvements also must be taken into account.

Yet this objection is not as basic as some others. Although both the beginning and advanced athlete can improve his performance, the rates of improvement that are possible for the beginner clearly exceed those possible for the front runner, and in this sense the gap will tend to narrow even if it never closes. Moreover, in the process of military modernization, there may be a point where a decisive qualitative transformation takes place, after which self-sustaining growth in military effectiveness becomes the norm. At the early stages of modernization there is primary reliance on foreign advisors, the social and cultural milieu resists improvements, and modern military systems remain foreign imports that cannot be fully absorbed by local personnel. But a later stage of modernization can build on the local accumulation of military capital, expertise, and experience; constant improvement is built into the system, and foreign technologies can be absorbed more rapidly. If the Arabs can achieve such a qualitative transformation, unilateral improvements may have an absolute effect on the military balance even if the Israelis also improve.

A second and more important objection is raised when levels of modernization are related to the operator and support personnel competence and organizational requirements imposed by the weapons being introduced. In practice, weapons differ in the level of skills they require of their operators, and the portion of combat

[1] Again, we remind the reader that this report was written before the recent upheaval in Iran.

outcomes explained by individual and organizational competence (as opposed to the inherent capabilities of the weapons themselves) is much greater for some systems than for others. For example, the effectiveness of long range, terminally guided, surface-to-surface missiles carrying large nuclear warheads against area targets is largely a function of the devices themselves and is quite insensitive to the skill of the operators. (But difficulties in programming the guidance systems may indeed vary with the skill of operators.)

In contrast, the effectiveness of an F-4 against a MiG-21 has been shown to be more related to pilot skill than to the inherent characteristics of the platforms and their weapon fits. (This was illustrated by the experience of U.S. Navy pilots in Indochina, who improved their dogfight kill ratios from 2.3:1 in the period 1965–68 to 12.5:1 in the period 1970–73 by going through the Dissimilar Air Combat pilot retraining program—a 400 percent improvement with the same equipment.) Also, the effectiveness of forces in the field is a function of the support systems backing them up, including all the elements in the maintenance, supply, and logistic train. Although for some systems the performance of the weapons themselves is the key, for many others what is done with the hardware is more important than its mechanical attributes.

To relate changes in the competence gap to changes in the military balance, we introduce an intervening variable: changes in the share of combat outcomes explained by human competence, itself a function of technology. Suppose, for example, the Arabs marginally improved their competence "rating" compared with that of the Israelis. At the same time new systems (e.g., advanced tactical fighters) were introduced whose operation and support *required* much greater competence. The net military balance might improve in favor of Israel even though the weapons were introduced on both sides and the rates of improvement in the human factor were greater on the Arab side. The key to this intervening variable between modernization rates and the military balance is the changing portion of the combat outcomes explained by differences in individual and collective competence.

This study has been concerned primarily with modernization itself; and we have seen that, with varying degrees of success, fairly rapid improvements are being undertaken in a number of countries. Although no effort has been made here to examine the Israeli case, it is probably fair to conclude that, for the reasons given above, on at least some characteristics the competence gap is gradually closing, if only because the Arabs started a considerable distance behind. The Arabs are also closing the qualitative gap in equipment by obtaining advanced European, Soviet, and American systems. These factors, combined with their quantitative superiority in weapons inventories and manpower, may lead observers to conclude that the net military balance is improving in the Arabs' favor and even that they are bound eventually to achieve strategic superiority.

But such an assessment may be altered when we consider the mission requirements of the various parties in greater detail, especially when offensive and defensive mission requirements are related to changes in prevailing military technology, as addressed below. The net assessment must also take account of the intervening variable between modernization and the military balance—the share of combat outcomes explained by human competence. To determine that share requires detailed study of future weapons inventories. It may be that the role of individual and collective competence is gaining importance more rapidly than the competence gap is narrowing.

It is important to distinguish two classes of competence questions: those pertaining to individual skills in the operation, repair, and provisioning of equipment sets *micro*-competence and those pertaining to collective capabilities to organize and operate forces effectively to fulfill military objectives *macro*-competence.)

At the micro level, there are countervailing trends. For some systems, the introduction of highly sophisticated but simple to operate weapons will reduce the influence of human skill in military operations. The closer we come to the mythical automated battlefield, with push-button "fire and forget" weapons, the less individual competence and initiative will count. New systems vary greatly in the expertise demanded of their operators, but some simplify the skills required of the actual user on the front line. For example, the second generation anti-tank missiles (TOW, Dragon, Milan) come closer to truly automatic guidance, once properly programmed, than the first-generation missiles they replace; and the eventual introduction of third generation systems will continue this evolution. Such developments reduce the advantage of technical sophistication and "brainpower" in the operation of weapons on the battlefield and act as an equalizer between armies of unequal skill (though even in these cases the supply and maintenance demands may be increasing).

For other systems, the importance of operator competence is growing. The F-15 is said to approach the limit of human mental endurance and capacity, because of the wide variety of platform and weapon control options that must be considered simultaneously. Even when one subsystem is improved for fairly automatic operation, as in the case of reliable all-aspect, fire-and-forget infrared-homing dogfight missiles, the optimal deployment of the platform and missile combination to obtain the greatest net utility from this advantage imposes greater than ever demands on the tactical ingenuity and inventiveness of the pilot, who must simultaneously consider all the other elements of the combat environment. Such developments increase the advantage of technical sophistication and widen the margin of inequality between forces of unequal skill.

Although it is difficult to derive summary conclusions at the micro level, at the macro level of competence the trends appear strongly to enhance the value of human effectiveness as a force multiplier. The effect of the technological revolution is to increase the demands on highly trained personnel and to heighten the advantage of an officer corps that can adapt, improvise, and manage efficiently. One factor is the molecularization of the battlefield. Because effective firepower is becoming increasingly light and compact, in the future mobile and fairly independent small units will often be used to threaten and destroy larger units in the Middle East and other places where the problems of target acquisition are reduced and there is a premium on mobility, concealment, and dispersal. More authority will have to be delegated to lower command levels, and the quality of junior officers and the intermediate ranks from captain to colonel will more heavily influence the effectiveness of the fighting forces. Improvisational tactics and operational flexibility will find their widest scope, and the net effect of the new technologies will enhance rather than reduce the importance of the qualitative human factor.

At the same time, maximum stress will be placed on the ability of the high command, control, and communication system where there is a proliferation of small units and a molecular pattern of deployment. This will multiply the advantage of the forces operating on interior rather than exterior lines, who are more readily able to concentrate against one vulnerable or high value point and then

another. This advantage will be further enhanced when combined with "mechanical" force multipliers such as the Hawkeye R-2C downward looking airborne radars and the integrated tactical ground environment computers.

Another factor at the higher levels of strategy and war planning is the very speed of technological change and innovation. An unprecedented number of systems incorporating new concepts are being introduced into this region simultaneously, and if there are future wars the participants will have to rely heavily on weapons never before operated under combat conditions. The performance of individual systems is bound to differ from simulations and results obtained on the testing ground. It will be necessary to modify organization, deployment, and tactics under the pressure of battle, and there will be substantial rewards to the side that is able to adapt more rapidly and absorb and integrate new equipment and ideas on shorter lead times.

In the coming years, a technological breakthrough or surprise is less likely to take the form of an unforeseen new weapon system per se than an innovative application of the known technology resulting from a superior understanding of its ultimate significance on the battlefield. Rapid adaptation of systems to meet new threats during the war, such as the devising of ECM responses to new radar threats, may be as important as the possession of the systems themselves. In these and other ways, the relationship between human capability and the rapidly changing equipment technologies may enhance the advantage of states favored by greater skills at the higher levels.

But these counterarguments and objections on the relationship between modernization and the military balance are complex and do not yield easily to quantification. If there is a narrowing of the competence gap combined with a narrowing of the qualitative gap in equipment, most observers will be attracted to the view that the military balance itself is improving for the Arabs correspondingly. Therefore, although the "objective" effect of modernization may not necessarily favor the Arabs, the subjective effect is quite likely to be a perception that the Arab military position has improved. It follows that whether or not modernization improves the military balance in favor of the Arabs, it will be perceived to do so, and to that degree military modernization will make the war option more attractive.

OTHER FACTORS IN THE MILITARY BALANCE

It is not possible to derive a net assessment of the regional military balance solely from the modernization factors examined in this report. A full study would have to examine in detail other elements such as:

- Offensive and defensive mission requiements;
- The military geography of assumed conflict theaters;
- Forces prepositioned in combat areas;
- Forces that could be mobilized or redeployed within relevant time frames;
- External supplies or support units that might be lifted to the conflict theaters;
- Comparisons of orders of battle, both quantitative and qualitative; and
- Intelligence capabilities.

In addition, scenario-specific assumptions must be made as to a number of contingencies, such as:

- The main military moves;
- Whether tactical and strategic surprises are achieved;
- Levels of mobilization over time;
- Whether pre-emptive options are exercised;
- The contributions of expeditionary forces by third and nth states;
- The participation or nonparticipation of superpowers; and
- The specific locations of military actions.

Finally, assessments must be made of the relative effectiveness of opposed systems (some never tested in battle) in given scenarios, such as:

- The state of the tank-antitank competitions;
- The fluidity of battle lines;
- The effectiveness of SAMs and SAM suppression weapons;
- The freedom of ground attack aircraft to operate effectively in various zones of the combat theater;
- Electronic systems vs. ECM vs. ECCM;
- Target acquisiton and terminal guidance systems vs. stealth technologies, decoys, and other anti-systems; and
- Mobility-enhancement and mobility-denial systems.

Most of these issues clearly fall outside the narrow question of modernization of human capital. Yet, modernization levels do affect net assessments, and it would be desirable to conduct follow-on research. The following examples illustrate but do not exhaust the researchable qustions.

First, modernization questions specific to particular technologies affect micro-competence in the absorption and effective operation of individual systems. For example, what is the potential of a given state to absorb and utilize numbers of a given aircraft, naval platform, land combat vehicle, weapon, or intelligence aid? How will the skill of operational personnel in this state compare with that of the adversary, and what will be the net effect on the military balance?

Second, does a given state have the organizational capability to structure given levels of combat manpower and equipment effectively into fighting units able to perform specified military tasks? This includes maintenance, repair, and logistic support; the ability to deliver combat units to critical points within restricted time frames; the coordination of command, control, communication, and intelligence under organizational stress; centralization and delegation of authority; and other elements of wartime management of fighting units.

Third, at the strategic level, is the national command authority able to proportion ends to means; to set mission requirements that are attainable by available forces and make optimal use of resources; to adapt war plans to take account of changing circumstances; to devise effective courses of action; and to integrate military and political objectives?

These issues of individual, organizational, and strategic competence have been addressed at a general level in this study, but a weapon-specific and mission-specific analysis is a task for the future.

CONCLUSIONS

With regard to states active in the Arab-Israeli balance, we have identified some significant trends of improvement in *micro*-competence, the factors affecting the performance of individuals. But the findings also suggest that no significant breakthrough is likely in *macro*-competence, the organizational and managerial factors affecting the performance of fighting units. Therefore, it is unlikely that there will be a revolution in the net effectiveness of the Arabs over the next ten years, particularly if, as we have argued, competence itself has a growing influence on military outcomes.

With regard to the other military balances of the region, differences in comparative rates of modernization may be more significant. Iran before the recent upheaval seemed capable of a decisive improvement by achieving a qualitative transformation to ultimate modernity. If so, the military balance between Iran and the other states of the Gulf might have been fundamentally altered.

These conclusions suggest that the Arab states will not be able to close the gap with Israel over the next decade, and that they would have lost ground in relation to Iran had trends there continued, in spite of the great effort being undertaken and the progress being made. The widespread belief that time is on the side of the Arabs, and that the wind of history is behind the Arab sail, is not fully supported by a detailed examination of trends in modernization and projections over the next decade within the confines of this analysis. However, the improvements that are being achieved are likely to affect perceptions of Arab military effectiveness, and to that degree they may affect the strategic choices that are made.

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