



Measuring knowledge capital in Arab countries

This chapter attempts a quantitative measurement of the state of knowledge in Arab countries, focusing on knowledge capital, the core of the knowledge production process. Ideally, the chapter would provide the most accurate assessment possible of the state of knowledge in Arab countries at the beginning of the 21st century. Yet in practice this attempt faces many serious difficulties. The first is the poor database on knowledge, particularly on the quality of human capital accumulated through education. Another data gap relates to the quantity and quality of knowledge production in Arab countries: the information base on these aspects is woefully short on accurate and up-to-date data comparable across time and space. These gaps underscore that the establishment of such databases is one of the most pressing priorities in building the Arab knowledge society.

INTRODUCTION

Measuring knowledge is not easy - either conceptually, methodologically or practically. Knowledge consists of abstract, symbolic structures in the human mind that are almost impossible to grasp, even on an intellectual level, let alone when it comes to concrete measurement. Measurement becomes even more difficult when considering knowledge capital, the determinants of its growth and its effectiveness on the societal level. So a resort to approximate measurement becomes inevitable in order to arrive at a first approximation of knowledge capital, its growth rate and characteristics and particularly the infrastructure for its formation and development.

Knowledge, whether looked at as a system, wealth or capital, is a multidimensional and complex phenomenon. As a result, the comprehensive measurement of knowledge must

involve a relatively large number of indicators that would be difficult for the human mind to deal with simultaneously. To surmount this challenge, known statistical methods for constructing composite indices can be adopted. However, simplicity comes at a cost. Such methods are sometimes criticised for reducing complex phenomena to a single composite index that over-simplifies its subject's manifold dimensions and masks the information content of constituent indicators.

Consequently, this chapter adopts both approaches. It examines some basic indicators of knowledge acquisition in Arab countries that are especially relevant to building a knowledge society, as compared to other countries and regions of the world. But it also explores the construction of composite indices of knowledge acquisition that depend on the availability, and credibility, of various data.

Knowledge capital contains elements that are not readily quantifiable. Its measurement ought, therefore, to combine quantitative with other *qualitative* and *subjective* elements, especially when it comes to literary and artistic production. The Report team aimed to present a pilot opinion poll on those issues conducted among faculty staff members at Arab universities, as a sample of Arab intellectuals. Although the survey was designed to minimize difficulties to the extent possible, it still encountered obstacles typically faced when conducting research in Arab countries. Nevertheless, the attempt yielded useful information summarised later in this chapter.

In principle, it is advisable to take the quality of the elements of knowledge capital into consideration. The Mean Years of Schooling (MYS) indicator, for example, is a useful yet insufficient measure of human capital, the solid nucleus of knowledge capital. The MYS should rather be weighed by a measure of the quality

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of educational attainment (derived, for example, from international studies of educational attainment). This balancing is important since econometric analysis indicates that the quantity of educational attainment is not as strongly associated with economic output as its quality. Indeed, economic output becomes increasingly sensitive to educational attainment when the quality of education is taken into consideration (Fergany, 1998). In the case of scientific output, measured by the number of published articles in peer-reviewed journals, for example, quantity could be weighed by the frequency of citation, assuming multiple citations of a certain article are an indicator of its knowledge value.

The following attempt at measurement also compares Arab countries, individually and collectively, on the different criteria of knowledge capital, to other relevant countries and country groups in the world. The countries and groups taken for comparison include countries considered important from the comparative knowledge perspective. Those countries include, where the data permits, China and India, large nations with ancient civilisations, and the principal 'Asian Tigers' i.e. Korea, Taiwan and Hong Kong. All these countries are known to have adopted a knowledge-based approach to development, with recognised success.

It is necessary to comment once again on the paucity of data on most aspects of knowledge in Arab countries. This deficiency is a major obstacle to the accurate and comprehensive measurement of Arab knowledge in general and Arab knowledge capital in particular. Turning to international databases did not resolve the problem since data on Arab countries is generally scarce. For example, in the most important international database on educational attainment, indicators of MYS in 1990 were available for only 11 Arab countries. The number fell to 9 countries in 2000.

Measures of the *quality* of educational attainment were not available except for a single Arab country in each of the two years, (Jordan and Kuwait, respectively).

Data on expenditure on R&D relative to GDP at the end of the 20th century were available for only two Arab countries; the number of scientists and engineers was available for

only five Arab countries. Except for six Arab countries, the percentage of high-technology exports of total manufactured exports was not available.

THE ADEQUATE MEASUREMENT OF KNOWLEDGE CAPITAL

The adequate measurement of knowledge capital requires considering the following three main aspects of knowledge acquisition with their corresponding basic elements:

- a. **Knowledge Dissemination:** essentially through education, translation of books, mass media (press, radio and TV), cinema houses and theatres.
- b. **Knowledge Production:** in two dimensions: Inputs: knowledge workers, expenditure on R&D (quantity and structure), and R&D institutions. Output: including scientific publishing (quantity/quality), patents, the publication of books, literary (novels, stories and poetry) and artistic expression (drama, cinema and music).
- c. **Infrastructure for Knowledge Capital:** includes ICT infrastructure, R&D support institutions, and professional organisations of knowledge workers.

Adequate measurement, naturally, requires accurate, up-to-date and comparable information on all these fields in Arab countries as well as in the countries of comparison. The Report originally set out to explore how far Arab and international databases would allow for sufficient measurement of all these dimensions of knowledge capital. For reasons already stated, this initial ambition was set aside for more modest goals.

TOWARDS THE BETTER MEASUREMENT OF KNOWLEDGE CAPITAL IN ARAB COUNTRIES

Measuring knowledge capital and its characteristics and following up on their development and limitations are of special importance in Arab countries. The elements of knowledge capital are key in determining the ability to acquire knowledge and thus in building human development itself. Knowledge capital, its characteristics and development, are at the core of knowledge acquisition. For reasons

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noted, the current attempt to measure Arab knowledge capital is neither complete nor completely adequate. Yet it is important to make a serious start in this direction and to explore approaches and measures that, if taken further, would significantly strengthen the measurement of this crucial phenomenon.

The initial contours of some proposals are evident. To start, all periodic statistical operations (censuses and specialised surveys) should include elements for measuring human capital (i. e., educational attainment and experience¹). Efforts to quantify human capital should be complemented by good measures of its quality. This is attainable either by expanding the participation of Arab countries in international studies of the quality of educational attainment or – even better – by conducting Arab comparative studies on the quality of human capital. The latter, unlike international studies, would benefit from proficiency in the Arabic language assessed.

Good measurement of human capital is important yet insufficient. To arrive at an adequate measurement of knowledge capital as a building block of human development, consideration should be given to conducting specialised studies, both quantitative and non-quantitative, in various other departments of knowledge.

The prospects for better data on knowledge acquisition in the Arab countries would improve if pan-Arab or international organisations undertook to collect and evaluate such data, ensuring its maintenance, credibility and comparability.

A SURVEY OF ARAB INTELLECTUALS ON THE STATE OF KNOWLEDGE

As noted earlier, the Report team sought to poll a number of faculty members in Arab universities, representing a sample of Arab intellectuals across the region, on knowledge acquisition issues. Annex 2 includes a brief description of the design of the questionnaire and survey. At the time of writing, however, the team was able to ascertain such views in only seven Arab countries (Bahrain, Lebanon, Egypt, Sudan, Tunisia, Algeria and Morocco).

In four countries, the number of intellectuals who responded to the questionnaires was less than the targeted 96, bringing the total number of replies to only 383. This reduced the benefits of the exercise.

Thus, in presenting the results of this survey, it is emphasised that the sample used was not selected by a standard probability method, which would support generalised attributions to the Arab intellectual community at large. This does not, however, negate the usefulness of the responses. Each response is undeniably subjective, but the value of a subjective view on knowledge issues increases with the increase of the knowledge capital of the individual concerned. In the case of university faculty members in particular, their views acquire more importance because of their ability to contribute to the formation of human capital through their higher education functions. From a statistical point of view, subjectivity was restricted by canvassing the views of hundreds of faculty members of Arab universities, thus increasing the objectivity level of the sample¹.

The sample responding to the questionnaire was almost equally divided between men and women (56% men). Most of them were PhD holders (63%), and one-third master's degree holders (33%). The majority of them (58%) were specialised in humanities and social sciences.

The respondents generally expressed dissatisfaction with the status of knowledge acquisition in their countries (the average ratio of satisfaction was 38%). Satisfaction with the extent to which knowledge acquisition serves human development was even lower (35%). These assessments clearly reflect the urgent need to stimulate knowledge acquisition in Arab countries.

In characterising the knowledge acquisition process in their countries, the respondents came up with low rates in their evaluation, as indicated in figure 4.1.

- On a scale from 0-100% respondents rated freedom to pursue knowledge in their various fields at 41%.
- Conditions for knowledge acquisition in their fields of scholarship satisfied the right to knowledge at 33%.

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¹Research in some Arab countries indicates that experience takes precedence over educational attainment as a determinant of earnings. This implies an indirect recognition of the poor quality of educational attainment in the region.

Arab knowledge systems are neither sufficiently free nor adequately incentivised.

- Incentives to acquire knowledge were considered just 30% satisfactory.
- The extent to which knowledge acquisition in their disciplines serves human development was rated only 30%.
- The degree to which knowledge acquisition reflects cultural diversity scored 30%.
- The extent to which Arab knowledge acquisition takes into account the global state of the art was judged 30%.
- Improvements in knowledge acquisition in their branches of learning during the past 10 years were rated only 28%.

In short, according to the majority of scholars in this sample, and with the reservations indicated, Arab knowledge systems are neither

sufficiently free nor adequately incentivised. Arab knowledge pursuits do not serve human development adequately, nor do they reflect the cultural diversity of Arab society. Local knowledge development and acquisition do not capture or keep up with the global knowledge explosion. Finally, in the Arab world, knowledge acquisition rates compared to those of other regions have improved relatively slowly.

The questionnaire included questions comparing the status of different knowledge areas in the Arab world to their equivalents in certain non-Arab countries, including India, China and the East Asian Tigers. Respondents to the questionnaire clearly had difficulty answering these questions. Many answered with: "don't know". Indeed, only one-third of all respondents addressed questions requiring comparisons with non-Arab countries.

Women respondents were more critical than men, attaching less value to ongoing knowledge activities and evincing more concern over the absence of adequate incentives for knowledge development and acquisition across the spectrum of Arab endeavours.

Holders of a master's and PhD degree, were more critical of the status of current knowledge acquisition than holders of lower degrees. PhD holders rated Arab knowledge performance lowest compared to India and the East Asian tigers, see figure 4.2.

Respondents from scientific disciplines generally took a dimmer view of the state of Arab knowledge than those from the social and human sciences. The latter group's assessment tended to be lower relative to the comparator countries. Many of the respondents lacked knowledge of translated books, reflected in the number of "don't know" responses to this question across all categories of the survey.

Figure 4.3 reflects the respondents' evaluations of the extent of freedom in key areas of knowledge compared to their assessments of incentives for its acquisition. The scale 0% – 50% reflects the low overall estimate of both freedom and incentives.

Respondents evidently judged that the extent of freedom, low as it is, is higher in general than levels of incentives to acquire knowledge, particularly in higher education,

Figure 4.1
Assessment of key features of knowledge acquisition in Arab countries by gender of respondent (%)

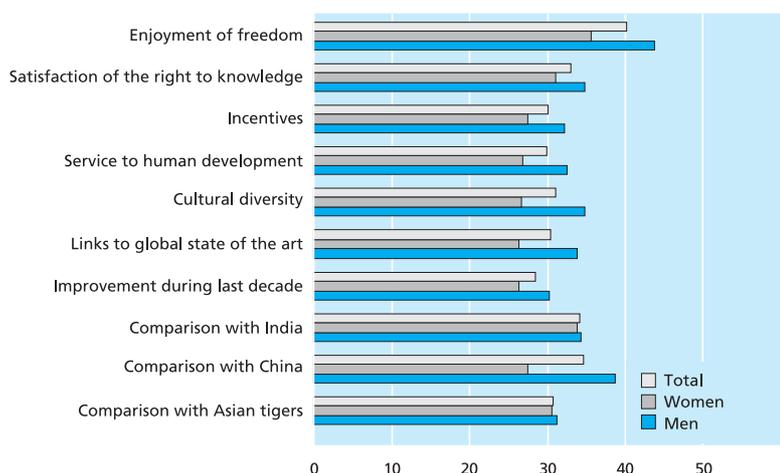
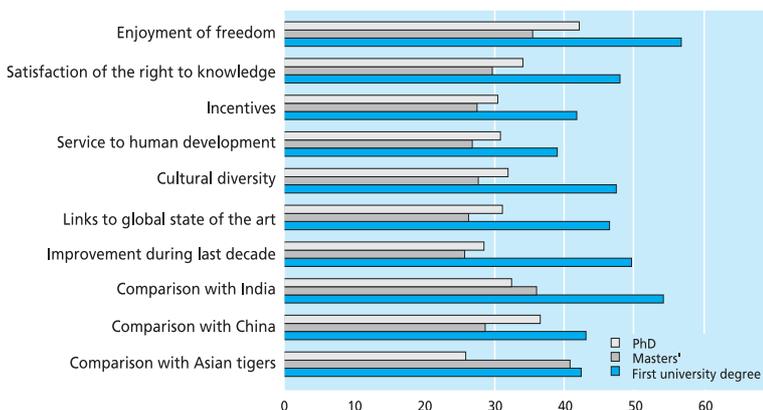


Figure 4.2
Assessment of the knowledge acquisition process in Arab countries by academic level of respondent (%)



research and development and arts production. This suggests the existence of obstacles to knowledge acquisition in Arab societies beyond questions of freedom. Two areas of knowledge activity, radio and television, were clearly judged to be very circumscribed in terms of freedom. Cinema and theatre production, on the other hand, did not appear as constrained. Thus, relatively low levels of production in the latter two areas could be attributed to organisational and financial problems; the same observation applies to scientific research and technological development in public sector projects.

Most respondents thought that Arab countries are weak in technological research and development, particularly compared to the East Asian tigers, despite their opinion that there is no restriction of freedom in this area: the discrepancy points to other (societal) obstacles. On improvements in knowledge acquisition over the past ten years, the lowest assessment was given to basic and secondary education, the two areas most consistently faulted by Arab university faculties.

Respondents considered that the most important impediment to knowledge acquisition in Arab countries is the deficient knowledge system itself. They focused on a general lack of resources and facilities and weak teaching systems, followed by poor governance and management, stressing restrictions on freedom and on civil society. They also evinced keen interest in seeing society provide better material and moral rewards for contributions to knowledge acquisition.

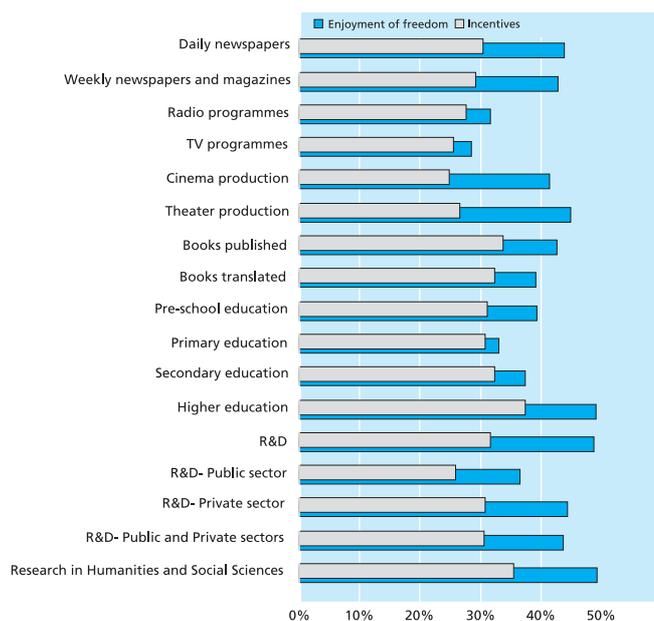
INITIAL APPROXIMATION OF THE MEASUREMENT OF KNOWLEDGE CAPITAL: HUMAN CAPITAL

The paramount importance of education and learning in the knowledge system has been highlighted in Chapter 1. This pivotal relationship suggests that human capital, which is the sum total of knowledge, capacities and skills acquired by human beings through education and practical experience, represents a relatively solid nucleus of knowledge capital.

Databases on human capital are well stocked since educational statistics are relatively accessible and are regularly available.

Figure 4.3

Freedom to pursue knowledge and incentives for knowledge acquisition



Yet those statistics have their weaknesses: they tend, on the one hand, to exclude knowledge acquisition through practical experience on which acceptable measures are available only through specialised field surveys. On the other hand, readily available educational statistics relate generally to the quantitative aspects of education, such as enrolment. Data related to the quality of education, on the contrary, are much less plentiful and often less credible, since they normally relate to *inputs* to the educational process (spending levels, number of schools, classrooms or teachers), or to *intermediate* indicators (e.g., the proportion of pupils to teachers, classrooms or laboratories).

Capturing the real outcomes of the educational process, reflected in the knowledge, capacities and skills students actually acquire, requires specialised field surveys, preferably of a comparative nature. Such studies would help ascertain the relative position of educational outcomes in one society as compared to other similar or competitive cases.

Efforts to measure the quality of Arab education are still limited – in itself an indication of a crisis in education in the Arab countries – and thus only a few, scattered measures of the quality of educational outcomes are available. They are found in international studies, which are marred in turn by their own shortcomings. For example, they exclude language from their testable fields. Moreover, very few Arab coun-

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tries have participated in such studies (Jordan and Kuwait were the only Arab countries that took part in one of two international studies conducted at the beginning and in the middle of the 1990s, respectively).

The stock of human capital at the beginning of the 21st century

The MYS (for populations older than a minimum age limit, usually 15 or 25 years²) is the most common indicator for measuring the stock of human capital through education. It is not, however, free of drawbacks. Apart from the shortcomings of averages – the most dangerous of which is neglecting the question of distribution within the society concerned – the most significant limitation of this indicator is its confinement to formal education. It excludes non-formal education and the acquisition of knowledge through experience. But even in this confined domain, the MYS, as an indicator of human capital, neglects the quality dimension. This at a time when evidence is accumulating to the effect that quality, rather than quantity, is the more important determinant of productivity enhancement and progress through knowledge acquisition and innovation.

Figure 4.4 illustrates the position of Arab countries with available MYS data at the beginning and end of the 1990s, relative to seven

comparison countries with available MYS data as well. It also shows averages for all Arab countries and for sub-groups of the countries compared.

From the figure it is clear that:

First: Arab countries fall far below the countries in the comparison, the Asian Tigers in particular.

Second: the MYS of all countries included have improved between 1990 and 2000. The improvement, on average, appears larger in the Arab countries than in the comparator countries as a whole or even in the Asian Tigers. The improvement, however, should be weighed against the fact that the lower the initial position of a country's MYS, the easier it is for it to make gains on the scale. In other words, the countries compared preceded the Arab countries in raising their MYS to a peak level at which point further improvement becomes harder.

HISTORICAL COMPARISON: ARAB COUNTRIES AND THE ASIAN TIGERS IN THE SECOND HALF OF THE 20th CENTURY

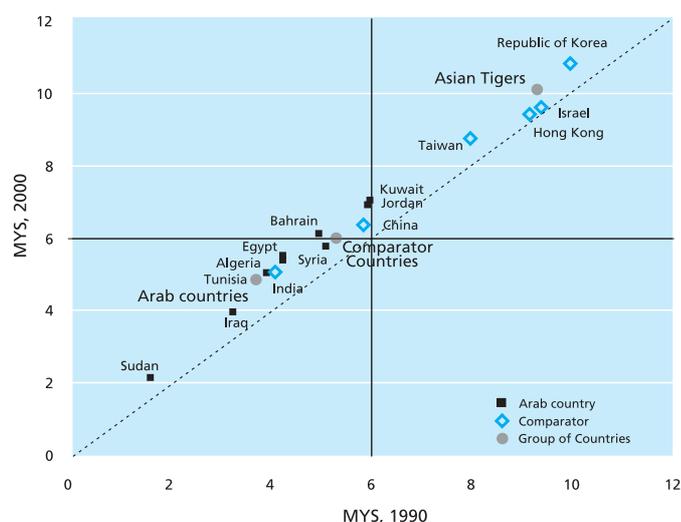
This next section traces the development of educational attainment in Arab countries in the last four decades, focusing on a comparison with the Asian Tigers. For a more valid comparison, the criterion used here is the MYS for people 25 years of age or older.

Literature on the "Asian Miracle" has accumulated in recent years. From an Arab perspective, the "miracle" factor is quite intense since in conventional economic development terms Arab countries used to fare better relative to the Asian tigers. But in 1970 Arab GDP per capita was half that in East Asia: by the opening stages of this century it dropped to less than one seventh of GDP per capita in that region. This is due to the significant improvement in economic performance in East Asian countries since the 1970s when there was a decline, albeit slight, in Arab countries (table 4.1).

One of the most important developmental lessons of the Asian experience is the critical role that early and intensive investment in human capital played as the foundation of de-

In 1970 Arab GDP per capita was half that in East Asia: by the opening stages of this century it dropped to less than one seventh of GDP per capita in that region.

Figure 4.4
Mean years of schooling (MYS), population 15 years of age or older, Arab countries compared to selected countries, 1990 and 2000



Source: Barro and Lee, 2000.

²The latter age limit (25 years) takes into consideration educational attainment levels among the older groups of the population. This age range tends to "penalise" Arab countries, since education is widespread among younger Arabs whereas illiteracy is still rife among older age groups.

velopment. Does the disparity in human capital formation between Arab and East Asian countries account for their divergent development fortunes?

To try and answer this question, one of the richest international databases on educational attainment (Barro and Lee, 2000) was used. Through it, the MYS in nine Arab countries on which data was available throughout the comparison period (and comprising about two thirds of the Arab population in the year 2000) was compared to the MYS for three pioneer Asian Tigers.

Figure 4.5 illustrates the large gap in the level of human capital formation between both groups (Arab countries and Asian Tigers) since 1960, disaggregated by gender.

Arab countries, obviously, did not manage to narrow the gap that separates them from East Asia in this respect. Rather, the gap widened, as the difference in educational attainment in general grew larger: from 3.02 years in 1960 to 5.26 in 2000. The gap was relatively wider among females, increasing from 1.87 to 5.42 years over the same period, despite the fact that the distance between the two groups on the individual progress lines, as shown in the figure, is less in the case of females. This is because the Arab countries with high levels of educational attainment among

TABLE 4.1
Percentage of real Arab GDP per capita (1970 and 2001), compared to Asian Tigers

Year	Arab countries	East Asian Tigers
1970	9	18
2001	7	52

Source: UNDP, Calculations by the Human Development Report Office.

their female population were among the less populated oil producing countries.

The level of human capital formation in the three Asian Tigers was substantially higher than that in the Arab countries at the beginning of the comparison period (1960). In addition, improvement in educational attainment in the first group was faster, noting that educational expansion becomes increasingly harder to achieve when higher levels of educational attainment are reached.

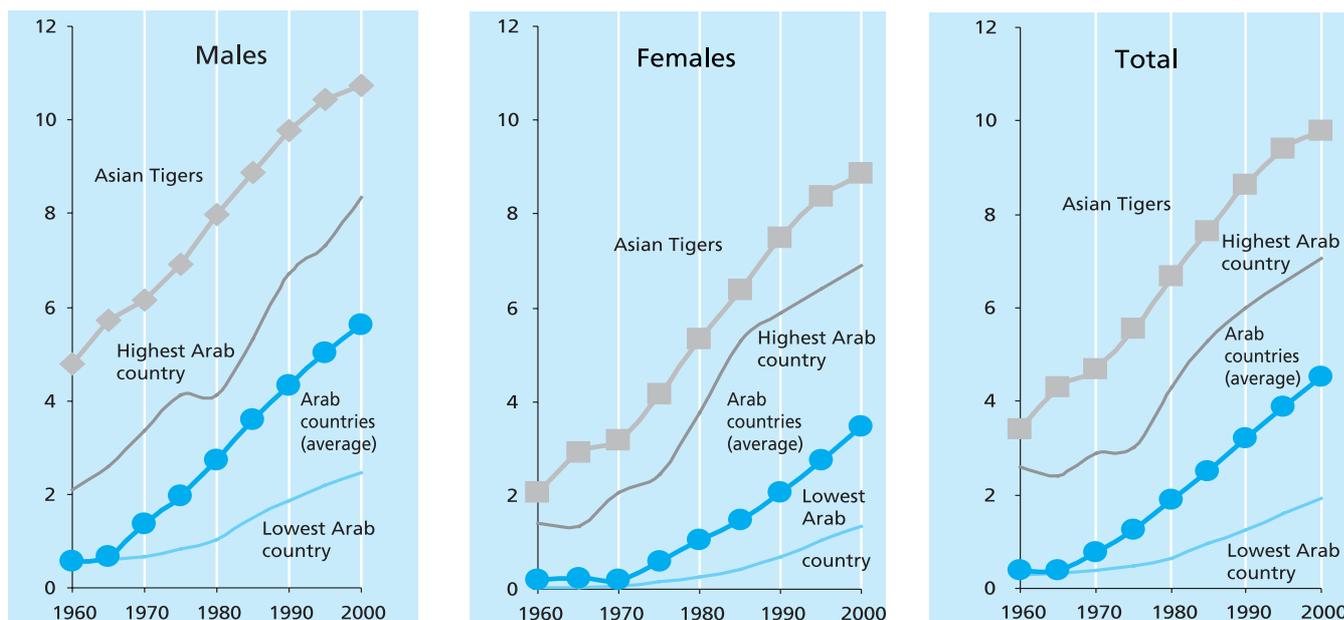
Moreover, the gap between the two groups would have appeared even wider had the averages included values for the Arab countries on which no data had been available. With the exception of a few low-population countries such as Lebanon, this category comprises the majority of less developed countries in the region and other countries with relatively low educational attainment.³

The comparison at hand reveals one of the most important "secrets" accounting for the successful East Asian development experi-

Does the disparity in human capital formation between Arab and East Asian countries account for their divergent development fortunes?

Figure 4.5

Mean years of schooling (population 25 years of age or older) by gender, Arab countries and three Asian Tigers, 1960-2000



³Countries with no available data: Comoros Islands, Djibouti, Somalia, Mauritania, Yemen, Morocco, Libya, Saudi Arabia, United Arab Emirates, Oman, Qatar, Lebanon and Palestine.

ence: *early and intensive investment in education, accompanied by sustained and rapid improvement of its level.*

The quality of education: findings of international studies

As mentioned earlier, the number of Arab countries with comparative measurements of the quality of educational attainment dwindles to only one in each of the two international studies available. To benefit from this scant information, it was assumed that the average relative score for both countries in the two studies applied to all Arab countries at the end of the 20th century.

However, before continuing with the analysis on the basis of this assumption, it is worth noting that this average is attributed to two countries where the quality of education can be expected to be better than the average for all Arab countries. Jordan, for example, is known to have a relatively better educational system and a high societal motivation for education. Kuwait, with its relatively generous spending on education, also stands out among the Arab countries.

Thus, it can be said without exaggeration that the average quality of educational attainment in Jordan and Kuwait is expected to surpass that in the majority of Arab countries, particularly the countries with limited educa-

tion budgets and those with disadvantageous legacies in education. This means that the relative position of the Arab countries, as a result of applying the average quality indicator of Jordan and Kuwait to all Arab countries, is a projection brighter than the present Arab reality.

Figure 4.6 illustrates the relative position of Arab countries between 1990 and 2000 on a human capital composite index. In addition to the MYS, the index takes into consideration the quality of educational attainment (by multiplying the MYS by a coefficient for the quality of educational attainment). Compared to figure 4.4, the figure shows an increasing divergence between Arab countries on the one hand and the comparator countries in general on the other hand. In other words, taking the quality of human capital into account accentuates the relative backwardness of the Arab countries vis-à-vis the other countries in this comparison, notably the Asian Tigers.

It is reiterated that the comparison at hand and the inferences drawn are rather weak owing to the scarcity of data on the components of the composite index, especially on the quality of educational attainment.

TOWARDS A COMPOSITE INDEX OF KNOWLEDGE CAPITAL

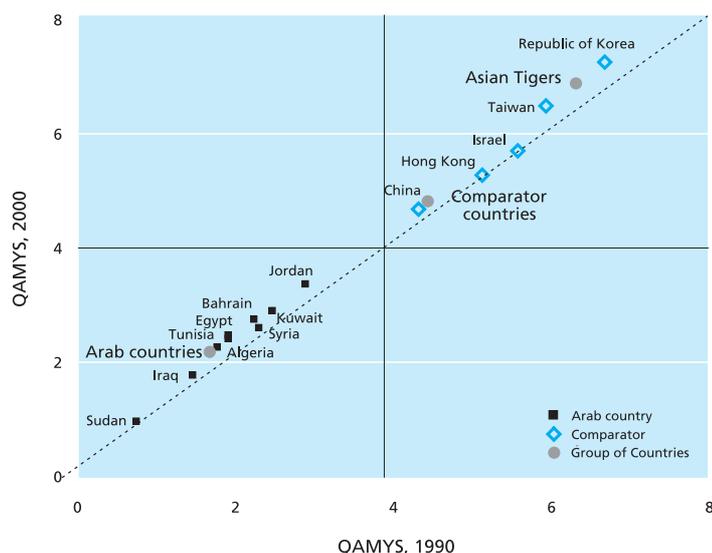
This section seeks to characterise knowledge capital in Arab countries within the comparative framework adopted. Although the multiple facets of knowledge enjoin the use of multiple indicators, data availability on any indicator, in Arab countries and the world at large, was a major criterion for including that indicator in the analysis. Taking into account the earlier discussion about measuring knowledge capital adequately, it was decided to consider ten indicators relating to different facets of knowledge capital.

The following are the ten indicators on which data were available worldwide and for Arab countries around the year 2000:

1. The quality-adjusted MYS
2. Daily newspapers (per 1000 people)
3. Radios (per 100 people)
4. TV sets (per 1000 people)
5. Scientists and engineers (per million people)
6. Patent applications filed (per million people)

Taking the quality of human capital into account accentuates the relative backwardness of the Arab countries.

Figure 4.6
Quality adjusted mean years of schooling (QAMYS), population 15 years of age or older, Arab countries and selected countries, 1990 and 2000



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7. Book titles (per million people)
8. Telephone mainlines (per 1000 people)
9. Cellular mobile subscribers (per 1000 people) and
10. Internet hosts (per 1000 people).

Table A-10 in the statistical annex gives the values of those ten indicators, which were available on 109 countries, including eight Arab countries and five of the countries chosen for comparison. There were, however, no good data available on all indicators for all the countries. The percentage of the countries with non-available data varied from one indicator to the other; all countries had data available on information infrastructure whereas more than a quarter of them had no data available on some basic indicators, e.g., scientists and engineers engaged in R&D, the number of book titles, and even on the core indicator, the quality-adjusted MYS.

To overcome these limitations in the basic data, statistical means for estimating the missing observations, based on the values of those available, were resorted to. The result was a completed array of data; Table A-11 of the statistical annex shows the completed data set, with imputed values for missing observations framed.

The 'Borda' rule was applied to the completed data array. The rule consists of assigning an overall rank to each country through summing its ranks on each of the ten indicators. This overall rank represents a valid "social welfare function". The result of this procedure is given in Figure 4.7, where the lowest rank is the best.

In general, the figure indicates the relatively low position of the Arab countries included in the analysis (the average overall rank for the eight Arab countries included is 69).

Yet a striking disparity is evident in the relative positions of individual Arab countries. Dividing the index into four groups, stagnant, intermediate, aspiring and leading, puts Korea among the leaders while only one Arab country, Kuwait, falls within the aspiring group. Other Arab countries for which data was available occupy intermediate or stagnant positions. (Several Arab countries without data would undoubtedly have fallen into the lower positions on the knowledge capital contin-

uum).

More importantly, the conclusions implied by the figure cast considerable doubt on both the indicators used and the prototype composite index itself. For example, India, with its nuclear capability, space programme and otherwise recognised technological capacity in more than one sphere, occupies the tail of the composite index along with some Arab and other countries notwithstanding the fact that there is a significant gap between these countries in terms of their scientific and technological capabilities.

This prompted an enquiry into the knowledge outcomes which signify the presence of knowledge capabilities and a comparison between them and the composite index just discussed.

The knowledge outcomes considered included the following:

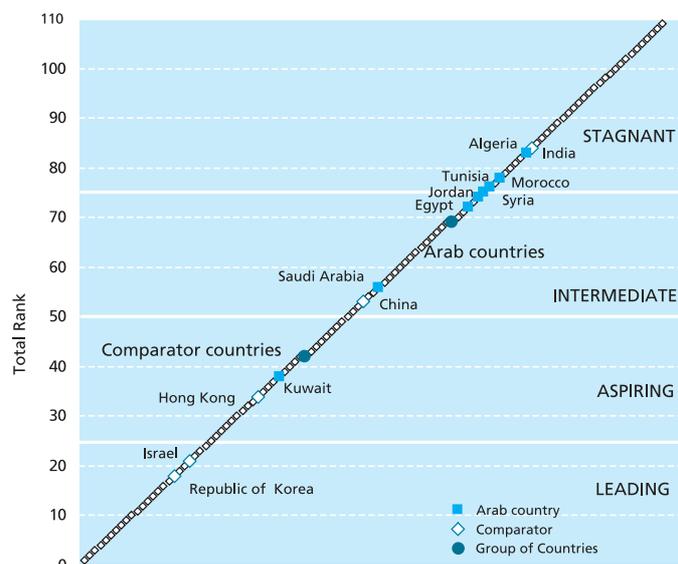
- High technology exports (as a percentage of total commodity exports)
- Nuclear facilities (ownership of a nuclear reactor)
- Existence of a space program

In addition to:

- Technology Achievement Index (TAI) values (UNDP), as well as some standard development indicators:
- Arab Human Development Index (AHDI) rank
- Human Development Index (HDI) value

Figure 4.7

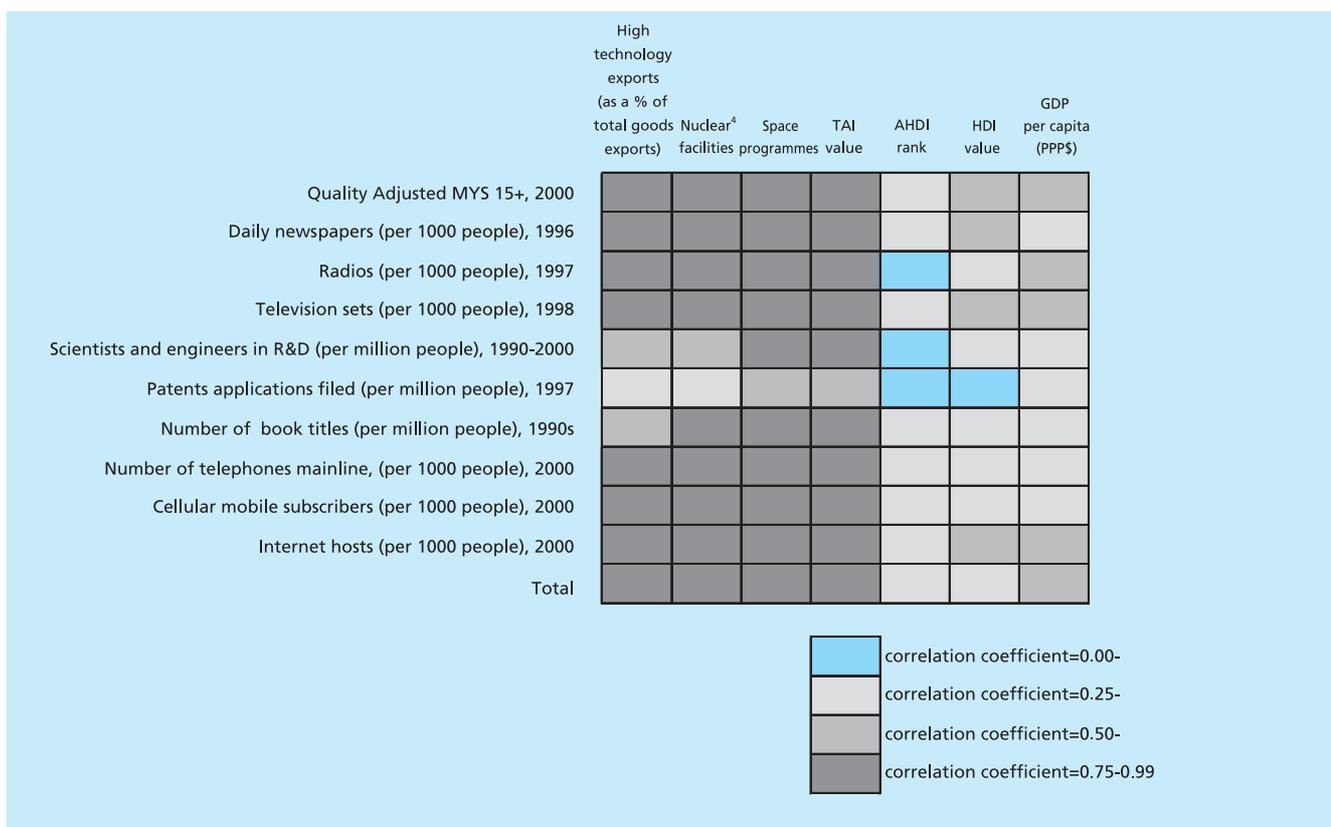
Ranking of Arab countries compared to other countries and regions on the composite indicator of knowledge capital, 2000



Dividing the index into four groups, stagnant, intermediate, aspiring and leading, puts Korea among the leaders while only one Arab country, Kuwait, falls within the aspiring group.

Figure 4.8

Correlation coefficient between knowledge capital indicators, knowledge outcomes and other development indicators around the year 2000



Cumulative knowledge outcomes offer decisive insights into how knowledge advances are achieved.

Motivated societies can lift themselves by their bootstraps to achieve large knowledge outcomes ostensibly beyond their means.

- Per capita GDP (in PPP, US dollars). Data on these indicators are given in Table A-13 of the statistical annex.

Analysing the relationship between the ten knowledge capital indicators utilised in the prototype composite index and these knowledge outcome indicators, (Figure 4.8 and Table A-14 in the statistical annex), demonstrates a relatively weak correlation between both groups of indicators, with the exception of human capital (quality and quantity) where the correlation with knowledge outcomes is relatively strong.

The question now is: what do we eventually conclude from this measurement attempt?

A valid, simple yet perhaps overly simple conclusion is that the indicators used are substantively inadequate and that data scarcity is a major impediment to adequate measurement, aggravating the substantive deficiency of the indicators.

The Report team’s preferred conclusion, however, is that cumulative knowledge outcomes offer decisive insights into how knowledge advances are achieved. It is evidently possible for societies to make substantial advances in knowledge even when their standard indicators of knowledge capital are modest – as in the cases of large countries such as India and China. This suggests that valuable knowledge achievements might depend crucially on matters that involve: political will and leadership; the capacity to raise and mobilise material, technical and human resources; and the drive to focus national efforts on attaining an indigenous societal renaissance that is both people-centred and patriotic. *Motivated societies can lift themselves by their bootstraps to achieve large knowledge outcomes ostensibly beyond their means.*

⁴ownership of a reactor

Despite the methodological and other challenges encountered in this attempt at measurement, it is quite evident that Arab countries lag behind the more advanced developing countries in building knowledge capital. The comparison is even more disquieting relative to the performance of the world's front-runners in knowledge capital formation and knowledge production.

Arab countries should, however, not take this as discouragement. Rather, these insights signpost another way forward, one that may lie much less in catching up with others on standard knowledge indicators, and much more through concentrating on knowledge outcomes. With robust and intellectually distinguished institutional structures, and with political determination supported by sufficient resources, particularly on the pan-Arab level, it may well be possible to emulate some of the striking knowledge outcomes of other developing countries whose conventional knowledge indicators do not surpass those found in the Arab world.