Chapter 5
Assessment of Skill and Technology Indicators

5.1 Introduction

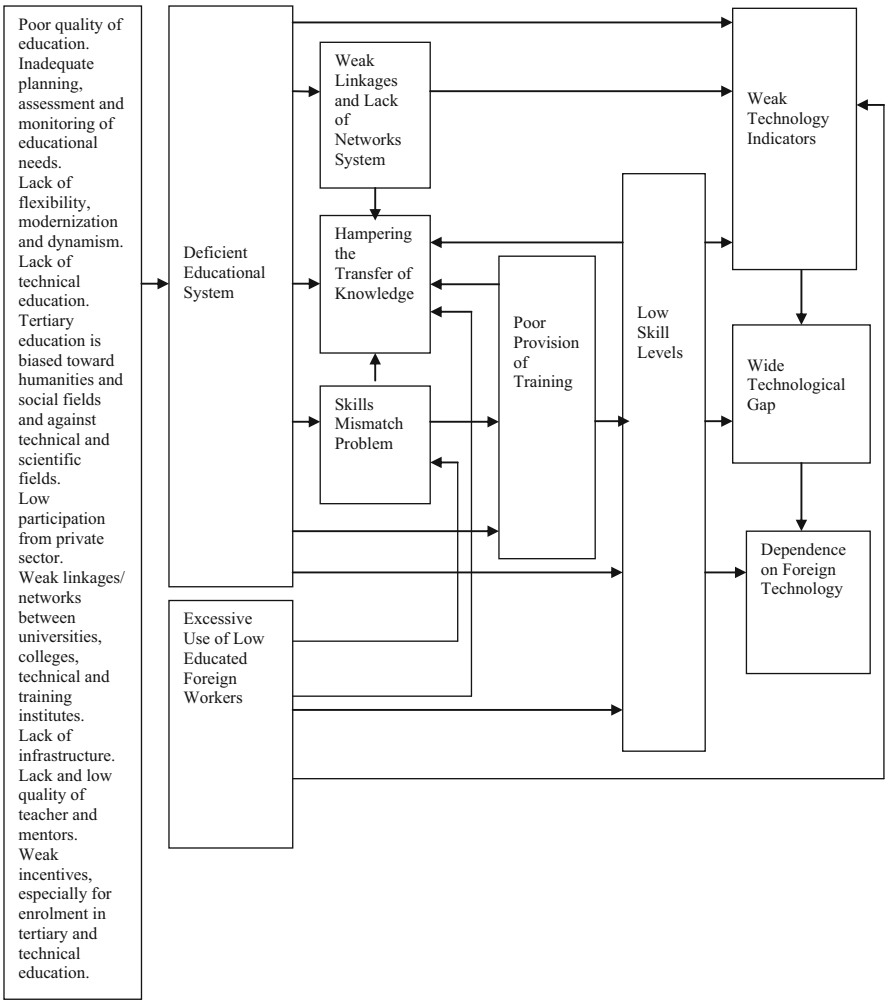
In this chapter we use the data and results of the firm and macro surveys set out in Chap. 4 to examine the third hypothesis in Chap. 1 about the serious implications of the interaction between the deficient educational system and the high incidence of unskilled foreign workers. In particular, we use the results of the macro survey to show the causes of the deficient educational system and consequences on low skill levels, poor provision of training, skills mismatch and low transfer of knowledge at the macro level. In addition, we use the results of the firm survey to illustrate that the high incidence of unskilled foreign workers leads to low skill level, poor provision of training, skills mismatch, poor technology indicators and a heavy dependence on foreign technologies. The rest of this chapter is organized as follows: Sect. 5.2 shows the causes and consequences of the deficient educational system and the high incidence of unskilled foreign workers and their implications on low skill levels, poor provision of training, skills mismatch, lack of knowledge transfer, low level of local technology and heavy dependence on foreign technology. Section 5.3 presents the micro–macro views about the upgrading of skill and technology and their potential implications. Section 5.4 provides the conclusions. The main ideas discussed in this chapter are summarized in Scheme 5.1 below.

5.2 Causes and Consequences of Deficient Educational System

The results of the macro survey indicate that, at the aggregate level, the official efforts to promote and upgrade the levels of local skill have been relatively successful only in some sectors.[1] In general, there has been a serious failure and

[1] As reported by 63 % of the respondent policy makers and experts to the macro survey.

S. Mohamed Nour, *Technological Change and Skill Development in Arab Gulf Countries*, Contributions to Economics, DOI 10.1007/978-3-319-01916-1_5,



Scheme 5.1 The causes and consequences of the deficient educational system and the excessive use of low educated foreign workers

shortcoming of the upskilling process, which is mainly attributed to: (1) inadequate training provision; (2) the deficient educational system; (3) misallocation of resources; and (4) failure of educated and trained workers to transfer knowledge.[2]

We begin our discussion by the second reason i.e. the deficient educational system, because we want to argue that both inadequate training provision and the failure of educated and trained workers to transfer knowledge are direct

[2] As indicated by 97 %, 83 %, 70 % and 70 % of the respondent policy makers and experts respectively.

implications of deficient education, while the misallocation of resources is indicated as one cause of both deficient education and the poor provision of training.

5.2.1 Causes of Deficiency in the Educational System

With respect to the second cause, Table 5.1 shows that the deficiencies of the educational system appear in both the basic and tertiary educational systems. Major causes are the inadequate assessment and monitoring of educational needs, low quality and internal efficiency of the educational system, and inadequate planning. Other important factors are the weak linkages/networks between universities, colleges, technical and training institutes, the lack of flexibility of educational institutions, the weak incentives for enrolment in technical education and the lack of modernization and dynamism. Finally, the low involvement and spending by the private sector and the low spending in technical education are also mentioned, but are of somewhat less importance. That also holds good for the lack of infrastructure (due to inadequate investment/public spending on education) and the lack of teachers and mentors. For instance, the share of public spending on education in GDP in the UAE (1.9 %) is low compared to other Gulf countries like Saudi Arabia (9.5 %) and other advanced Asian countries such as Korea (3.6 %) and Malaysia (7.9 %) (The UNDP, 2004) – see our discussion of the supply side of educational policies in Chap. 8. Moreover, according to the twin-peaks analysis in Ziesemer (2004), which compares the distribution of public spending on education across countries, the UAE's less than 2 % public spending on education falls below the average 4.6 % of public spending on education to improve the accumulation of human capital in 1998.

We observe that, according to 82 % of the respondents to the macro survey, the low quality and efficiency of the educational system appears from the low quality at basic, secondary and tertiary education relative to international standards. Important causes are the low rates of accomplishments and motivation at higher secondary and tertiary education levels relative to international standards, but the problem is somewhat less at the basic education level. Another serious problem is the low quality of teachers and mentors,[3] while less important causes include, the high pupil/teacher ratios, the low public current expenditure per pupil, the low survival rates and high drop-out and the high repetition rates.[4, 5]

[3] As reported by 79 % of the respondent policy makers and experts to the macro survey.

[4] As indicated by about 61 %, 54 %, 50%and 50 % of the respondent policy makers and experts to the macro survey respectively.

[5] We observe that the presence of high drop-out levels in the transition from schooling education to university education, which implies the lack of social awareness of the importance of tertiary education or preference of more certain short term return to available jobs than long term investment in education and skills.

Table 5.1 The causes of deficient educational system in the UAE, 2002

Causes of deficiency	General educational system (basic + tertiary) (%)	Basic education (%)	Tertiary education (%)
Inadequate assessments and monitoring of educational needs	84.5	83	86
Low quality/efficiency of educational system	82.5	79	86
Inadequate planning for educational needs	82.5	79	86
Lack of flexibility of educational institutions	77.5	76	79
Weak incentives for enrolment in technical education	75.5	76	75
Lack of modernization and dynamism	73.5	76	71
Low involvement and spending by private sector	70	72	68
Low spending in technical education	68.5	69	68
Weak linkages [networks] between universities, colleges, technical and the training institutes	79	–	79
Lack of infrastructures due to Inadequate investment (public spending on education)	58	55	61
Lack of teachers and mentors	54.5	55	54

Source: Own calculation based on the Macro Survey (2002)

5.2.2 Consequences of the Deficient Educational System

5.2.2.1 Mismatch Between the Output of Education and the Market Needs

We find that both the deficient basic (primary and secondary) and tertiary educational systems together lead to serious mismatch between the output of education and the market needs. In particular, about 96 % of the respondents to the macro survey reported that the mismatch is mainly attributed to deficiency of both tertiary and basic education. Moreover, the follow-up interviews with policy makers and experts show that the mismatch is attributed to the deficient educational system,[6] the lack of coordination and planning to meet the critical skill needs and the cultural/social reasons: preference for white-collar jobs and biased against technical education and technical jobs. For instance, the deficiency of tertiary educational system is caused by the inconsistent structure: the share of students enrolled in the UAE between 1994 and 1997 in all social sciences, humanities and art faculties (73 %) was much higher than those of sciences, math and engineering (27 %).

[6] As in most other developing countries, the mismatch is attributed to deficiency in the educational system. Another interpretation in the Gulf countries attributes this to culture: i.e. preference for white-collar jobs.

The share of students enrolled in sciences, math and engineering in the UAE is also low compared to both Korea (34 %) and China (53 %) (The UNDP, 2002, 2003) – cf. our discussion on the demand for education in Chap. 8.[7]

5.2.2.2 Lowering Skill Levels

From the UAE Ministry of Economy (1985, 1995), (The UAE Population Census Data (1985, 1995)) and the educational matrix for the period 1985–1995 set out in Table 5.2, we observe the low skill levels – defined by educational level of total population. The share of low educated (71–66 %) is much higher than that of high educated (10–12 %) in total population. That also indicates a minimal skill upgrading, defined by the relative rise in the share of high educated population and the relative decline of the share of low educated population during the period 1985–1995.[8] In addition, the UAE Ministry of Planning Statistical data (1995–1997) on the distribution of economically active population by occupational classification (1985–1995) shows the low skill level defined by occupational levels, for instance, the share of unskilled population (86–81 %) is much higher than that of high skilled population (13–18 %). That also implies a slight improvement in skill

[7] These results are also consistent with the findings of both El Sabaa (1997) and Haan (1999) respectively. "Reviewing the numbers of student enrolled in the UAE University shows that the total number of enrolled students in engineering, science, agriculture and medicine faculties in 1994 was nearly 24 % of the total number of the enrolled students. While the number of other theoretical faculties, mainly, literature, economics, education, and law in the same year were accounting for 76 % of the total number of enrolled students. The other foreign and private faculties operating in the UAE are stressing on the theoretical branches of education. Similarly, the Higher Faculties of Technology are also allocated the larger part of its studies to business management at the expense of other technological and engineering branches. This leads to imbalanced distribution of graduates and the limited contribution of researchers, technologists and engineering to the local manpower: It is noticeable that the larger segment of local manpower tends to prefer managerial and commercial domains. Thus, the number of theoretical faculties graduates has been much more than the vacancies available in managerial careers and government services" (El Sabaa, pp. 20–21). "While the UAE has in recent years made progress in developing its human resource base, its educational system is still largely geared towards general education and most of the students in higher education are found in humanity and similar studies. Technical skills are lacking and technical education and training, which historically does not enjoy much status in society, are lagging far behind. For instance, from the HCTs, the first one of which only opened their doors in the late 1980s, have so far graduated only 264 engineers, some of these graduates still lack a great deal of field practice. Moreover, most of the qualified people with technical skills still end up working in the government and white collar work in general reflecting the bias against technical and manual work in particular, very, very few actually work in practical jobs in private firms and other jobs which would require them to work in the field" (Haan, p. 37).

[8] At the aggregate level, the educational matrix implies the distribution of population according to educational level: low level of education refers to illiterate, literate, primary and preparatory school; medium level of education includes secondary, post-secondary and below university; and high level of education includes university and postgraduate levels.

Table 5.2 The UAE educational matrix: the distribution of population by educational level (1985–1995)

1985		Low	Medium	High	Not stated	Total
Native	Male	0.079314	0.009192	0.005544	0.000012	0.094062
	Female	0.001677	0.002463	0.001705	0	0.005845
	Total	0.080991	0.011655	0.007249	0.000012	0.099907
Non-native	Male	0.585299	0.143734	0.081035	0.000209	0.810277
	Female	0.044652	0.02966	0.015462	0.000042	0.089815
	Total	0.629951	0.173394	0.096497	0.000252	0.900093
Total population		0.710942	0.185049	0.103746	0.000263	1
1995						
Native	Male	0.052143	0.017576	0.00929	0.00001	0.07902
	Female	0.001916	0.00433	0.005526	0.000001	0.011774
	Total	0.05406	0.021907	0.014816	0.000012	0.090794
Non-native	Male	0.557998	0.150259	0.093477	0.002628	0.804362
	Female	0.05228	0.032108	0.020365	0.000091	0.104844
	Total	0.610278	0.182367	0.113841	0.00272	0.909206
Total population		0.664338	0.204274	0.128657	0.002732	1

Source: Own calculation from the UAE Ministry of Economy (1985, 1995), "The UAE Population Census Data (1985, 1995)," UAE Ministry of Economy, Abu Dhabi, UAE, (1985, 1995).

upgrading defined by the increasing share of high skilled and a falling share of unskilled during the period (1985–1995). Furthermore, as we explain below, the low skill levels at the macro level is consistent with that at the micro level.

5.2.2.3 Hampering Transfer of Knowledge

Our results in Table 5.3 show that the low quality of education hindered the easy transfer of knowledge and external schooling effects. According to the macro survey, only 42 % of the respondent policy makers and experts reported that the incidence of knowledge transfer/external schooling effect is successful, while around 58 % reported that the transfer of knowledge/the external schooling effects are constrained by several factors. The major important factors include: the low quality of education, the low quality of training, prevailing conditions in the firm do not encourage external effects, failure of skilled workers to deliver knowledge to unskilled workers and failure of unskilled workers to acquire knowledge from skilled workers.[9]

[9] The transfer of knowledge and external schooling effects refers to knowledge transferred from knowledge holders (high skilled workers/people) to knowledge recipients (low skilled workers/people) – cf. Cowan, Soete and Tchervonnaya (2001, p. 9). Knowledge in this sense refers to know how or tacit knowledge embodied in people, and is different from the broad definition of technology, which refers to both embodied and disembodied knowledge.

Table 5.3 The factors constrained the transfer of knowledge/external schooling effect in the UAE, 2002

Factors constrained the transfer of knowledge/external effect of schooling	Officials (%)
Low quality/return from education	95
Low return form/quality of training compared to international standard	95
Prevailing conditions in the Firm conditions do not encourage the external effect	95
Failure of skilled workers to deliver their knowledge and experiences to benefit unskilled workers	90
Failure of unskilled workers to acquire the knowledge and experience from skilled workers	90

Source: Own calculation based on the Macro Survey (2002)

In strong contrast to this view, the results of the firm survey show that, at the micro/firm level, the incidence of knowledge transfer/external schooling effect is successful among 95 % of the respondents firms. It is only unsuccessful within two firms because of the following: the low quality of education, the low quality of training, the prevailing conditions in the firm do not encourage the external effects and the failure of unskilled workers to acquire knowledge from skilled workers.[10]

This contradicting optimistic-pessimistic views at the micro and macro levels regarding the incidence and success of knowledge transfer/external schooling effect implies that the transfer of knowledge/the external schooling effects is probably successful within firms but unsuccessful between firms and within society at large. This is consistent with our observations from the follow-up interviews that the transfer of knowledge is hindered by both the low quality of education and the lack of cooperation with university sector due to inadequate awareness and lack of social partnership between public sector, private sector, university sector and society. The weak linkages and lack of networks between universities, colleges, technical and training institutes and the productive sectors is mentioned by 79 % of the respondents to the macro survey as factor that constrains the efficiency of educational system – it probably also constrains the transfer of knowledge. An additional factor is that the transfer of knowledge within society at large is probably hindered by the imbalanced structure of population and labour market. Mainly due to the excessive share of foreign workers with different nationalities, cultures, languages, etc. that probably hindered their sufficient integration and interaction with local

[10] Another possible explanation for the low transfer of knowledge can be interpreted in relation to the prevailing conditions within private firms. Since within private firms most of the highly skilled posts as well as most of the low skilled posts are held by foreigners, there may be less incentives for the incidence of transfer of knowledge from high to low skilled workers.

workers and local population.[11] This is probably also due to a lack of incentives at the aggregate level.[12]

Finally, the macro survey indicates that the contribution of both educated and trained population to promote the local skills is constrained by several causes. Major causes are the lack of interaction to market needs (mismatch) and the lack of information on educational and training needs in the productive sectors and their demand for graduate students.[13] Other important causes are: risk aversion, i.e. the preference of more certain short term returns to available jobs than long term skill investments; the uncertainties about future skill needs; the lack of a system of certification of skilled acquired; and inadequate incentives for trainers.[14] Relatively less important causes include the uncertainties about the future value of investment in education and training and the high costs to finance education and training.[15] These factors probably also contribute to hinder the transfer of knowledge within society at large.

5.2.2.4 Poor Provision of Training

Both the deficient educational system and the excess supply of low skilled foreign workers lead to a low skill level and hinder the provision of training. Table 5.4 shows that both the policy makers and experts (officials) and firm managers mentioned the low educational qualifications of workers among the important factors constraining the provision of training. Other important factors are the lack of appreciation/information about training, inadequate assessment and planning for training programmes and the mismatch problem. Moreover, the results of the firm

[11] This result is consistent with the finding of El Sabaa (1997), who notes: "It is widely observed that industrial entrepreneurs in the technically advanced projects are strictly against leakage of their technologies outside their factories. Thus, they minimally contribute to developing the technology environment in the country. This adverse impact has been amplified by the unwillingness of foreign as well as local entrepreneurs to employ local manpower, to train them in their factories, either because they doubt their capabilities, or for fear to leaking their technology secret to other competitors. The limited supply of local industrial manpower, coincided with the unwillingness to employ them in both foreign and local industries applying advanced technologies, resulted in constricting the role supposed to be played by expatriate manpower in transferring technology to the industrial sector in the Gulf region. Moreover, the large scale industries despite using more sophisticated advanced technologies, however, they minimally contribute to elevate the technology transfer to the local industrial sector, as they strictly keep their operational and managerial techniques as top confidential secrete and prevent their leaking outside their units. To some extent, the chance of their flow to the rest of the operating factories seems better in the medium size factories" (El Sabaa, p. 22, pp. 24–25).

[12] The lack of transfer of knowledge can be interpreted as a lack of absorptive capacity, mainly related to deficiencies of education and continued dependence on imported technologies.

[13] As indicated by 82 % and 79 % of the respondent policy makers and experts respectively.

[14] As reported by 75 % of the respondent policy makers and experts.

[15] As indicated by 71 %, and 61 % of the respondent policy makers and experts respectively.

Table 5.4 The factors constrained the provision of training in the UAE, 2002

Factors constrained the provision of training	Official	All firms	Chemical	Metal	Medium	Large
Inadequate planning for training programme	93 %	42 %	43 %	40 %	50 %	25 %
Inadequate assessment of training needs	93 %	50 %	57 %	40 %	63 %	25 %
Mismatch between training programme and changing technical needs	96 %	33 %	29 %	40 %	38 %	25 %
Mismatch between training programmes and changing skill needs	96 %	33 %	29 %	40 %	38 %	25 %
Low quality of trainers and mentors	82 %	33 %	43 %	20 %	38 %	25 %
Low educational qualifications of workers	79 %	58 %	43 %	80 %	50 %	75 %
Lack of trainers and mentors	79 %	33 %	43 %	20 %	38 %	25 %
Lack of appreciation/information about training	75 %	50 %	57 %	40 %	63 %	25 %
Lack of specialized training institutions	79 %	33 %	29 %	40 %	50 %	
Lack of full appropriability of the return from training investment	71 %	33 %	29 %	40 %	50 %	
Lack of interactions between training institutions and firms	71 %	33 %	29 %	40 %	50 %	
Lack of finance to cover the cost of training	68 %	33 %	29 %	40 %	50 %	
Lack of training materials and equipment	68 %	33 %	29 %	40 %	38 %	25 %
High rate of mobility of trainers to move for better paid jobs after training	68 %	33 %	29 %	40 %	50 %	
Lack of a system of training certification of skills acquired	71 %	8 %	14 %		13 %	
Total response	28	12	7	5	8	4

Source: Own calculation based on the Macro Survey (2002), Firm Survey (2002)

survey illustrate that the low provision of training appears from the following: (1) The lack of an in house training unit – only 23 % of the respondent firms have an in house training unit; (2) The complete absence of public financial support: for instance, none of the respondent firms received any government subsidies to support training provision; (3) The selective training provision: in the year 2001, the priority for training among the respondent firms was mostly given to production workers, production engineering staff, management staff and services workers[16]; (4) The limited type of training: most of training provision is focused on the job training, and on the job and off the job combined, which are preferred by 87 % and 91 % of the respondent firms respectively. The other types of training such as: off the job within the firm (training centre), off the job outside the firm (outside the country) and (specialist training centre inside the country) are very limited.[17] (5) The limited sources of information about training opportunities, as most of

[16] As reported by 68 %, 54 %, 43 % and 35 % of the respondent firms respectively.

[17] As indicated by 55 %, 27 % and 27 % of the respondent firms respectively.

the information about training opportunities is provided by private trainers (local and foreign companies) and the chambers of commerce. Few firms find information from public educational institutions/universities, other firms working in the same sector, and government and semi government units.,[18, 19]

5.2.3 *Consequences of the Low Educational Qualifications of Foreign Workers at the Micro/Firm Level*

In Chap. 2 we explained that one well-known fact about the Gulf countries is the high share of foreign workers in total employment. In this section we show that next to the consequences of the deficient educational system at the macro level, the high incidence of unskilled foreign workers also causes several serious implications at the micro/firm level.

5.2.3.1 Low Skill Level and Skills Mismatch at the Micro/Firm Level

From the demand perspective, the results of the firm survey can be used to argue that firm demand for low skilled workers leads to an excessive share of low skilled

[18] As reported by 65 %, 42 %, 35 %, 29 % and 26 % of the respondent firms respectively.

[19] These results seem consistent with the findings of the earlier studies conducted by the UAE University (1994, 1997), Gray (1999) and Abdelkaraim and Haan (2002). For instance, the UAE Education Assessment Report (1994) shows that both technical and vocational education and training provision are unregulated, uncoordinated and unplanned, while the results of the UAE University (1997) show the limited contribution to private sector training provision by both the public and government sectors. Moreover, the findings of Gray (1999) show that only 30 % of the respondent firms provide systematic training. The provision of training is selective in most cases – focused on some occupational groups, but not others – and for two-thirds of the respondent firms, the provision of training was limited to on-the-job training. The study concluded that the UAE does not have a training-led employment culture. Employers have become used to bringing in their workers from outside the country with readymade skills and replacing them with similarly skilled workers. There has been little incentive to provide skill upgrading except in response to immediate needs such as the introduction of new technology. The local training industry has suffered from the uncoordinated nature of provision and the very limited contribution by public sector organisations and higher education institutions to this variety of provision. Most of training provision has been in low-investment, low-cost and quick-profit areas such as marketing, public relations, sales, computer awareness and management development. The private sector training is relatively undeveloped and un-coordinated, and has limited market due to both limited demand and limited supply. Moreover, the provision of public sector training is constrained by the inadequate involvement of public education institutions. For instance, the Higher Colleges of Technology (HCTs) had little involvement in the important area of adult technical education, including vocational training and retraining (Gray, p. 15, pp. 33–34, p. 43). Additionally, the findings of Abdelkaraim and Haan (2002) show that the UAE public sector training is still limited due to less attention, awareness and resources (Abdelkaraim & Haan, p. 15).

workers.[20] On the other hand, from the supply perspective, our findings from the firm survey show that the excessive share of low skilled foreign workers has direct implications in lowering skill levels at the micro/firm level. For instance, Table 5.5 below shows that across firms the average percentage share of low skilled workers (71 % and 75 %) is much higher than that of high-skilled workers (29 % and 25 %) defined by both educational and occupational classifications respectively. Moreover, Tables 5.4 and 5.5 show that the poor educational qualifications of foreign workers lead to poor provision of training – see our discussion above – and a serious skills mismatch across firms, as we will explain in detail in the next chapter.[21]

5.2.3.2 Weak Technology Indicators

From the demand perspective, the results of the firm survey can be used to argue that weak technology indicators lead firms to demand and rely heavily on low skilled workers. On the other hand, from the supply perspective, the excessive share of unskilled foreign workers leads to weak technology input–output indicators across firms. From Table 5.5 above, we observe that a weak R&D indicator appears from the following: (a) The limited R&D activities/efforts performed continuously or occasionally amongst only 37 % of all the respondents firms; (b) The limited R&D activities and expenditure particularly devoted/aimed at improving firm product and to produce a new product; (c) The low R&D expenditures and R&D expenditures as percentage of total output expenditures. For instance, amongst all the respondent firms, average R&D expenditure was around 0.9 million Dirhams,[22] while the average R&D expenditures as a percentage of total output (sales value) amongst all the respondents firms accounted for only 0.01 %; (d) The low number of both full time and part time R&D employees. For instance, a large majority

[20] It is convenient in this chapter to briefly indicate the consequences with respect to low skill and skills mismatch at the micro level and to discuss this more fully later in Chap. 6. That serves our aim in this chapter to compare and integrate the macro–micro consequences of low skill level – cf. Scheme 5.1. above. This brief discussion in this chapter also substantiates the third hypothesis in Chap. 1 above about the interaction between the deficient educational system at the macro level and the high incidence of unskilled foreign workers at the micro level and the serious implications on low skill levels and skills mismatch. It is appropriate to discuss the skills mismatch problem more extensively later in Chap. 6, where we provide a broader, more in-depth and coherent analysis of skill problem and the implications of the prevalence of low-skilled foreign workers at the micro/firm level.

[21] We define the mismatch as the differences between the required and actual education. Actual education refers to high (university and above), medium (secondary) and low (below secondary) levels of attained years of education that represent the supply of skills. We define the required education by the required qualifications for each of the occupational classes translated into average years of schooling that represent the demand for skills. We observe that the inconsistency between the required and actual education implies inconsistency between demand for and supply of skills, which we interpreted as skills mismatch – cf. the detailed discussion in Chap. 6 below.

[22] The value is measured in the UAE local currency: Dirham, which equalled 3.67 US Dollars when the survey was held (2002).

Table 5.5 Main technology and skill indicators defined by firm size and industry in the UAE, 2002

		Industry		Size	
Indicator	All firms	Chemical	Metal	Large	Medium
Skill and skills mismatch indicators					
Share of high skilled (education) (%)	29 %	35 %	23 %	33 %	27 %
Share of high skilled (occupation) (%)	25 %	28 %	21 %	21 %	28 %
Share of low skilled (education) (%)	71 %	65 %	77 %	67 %	73 %
Share of low skilled (occupation) (%)	75 %	72 %	79 %	79 %	72 %
Share of firm conducting R&D (%)	37 %	47.8 %	26.3 %	47.8 %	26.3 %
high skilled wages/low skilled wages	7.5	6.9	8.1	6.3	8.4
Share of firm with skills mismatch (%)					
The high skilled group(%)	29 %	28.6 %	30 %	35.7 %	20 %
The medium skilled group (%)	72 %	69.2 %	75 %	83.3 %	55.6 %
The low skilled group (%)	66 %	60 %	71.4 %	72.7 %	50 %
Technology indicators					
Share of R&D expenditure/total output (sales value) (%)	0.01 %	0.0115 %	0.005 %	0.017 %	0.014 %
Average R&D expenditure ($\times$1 million UAE Dirham)	0.9	1.5	0.2	1.4	0.5
Number of R&D employees (R)	$1 \leq R \geq 11$	$1 \leq R \geq 11$	$1 \leq R \leq 10$	$1 \leq R \geq 11$	$1 \leq R \leq 5$
Number of full time R&D employees	1–11	1–11	1–5	1–11	1–5
Number of part time R&D employees	$6 \leq R \geq 11$	$6 \leq R \geq 11$	6–10	$6 \leq R \geq 11$	0
Share of firm applying for patents (%)	13 %	13 %	0	12 %	0
Share of firm in total spending on ICT (%)	100 %	88 %	12 %	95 %	5 %
Share of firm in total spending on ICT training (%)	100 %	86 %	14 %	94 %	6 %
Share of firm in total spending on ICT (%)	69 %	67 %	72 %	73 %	65 %
Share of firm with spending on ICT training (%)	52 %	50 %	56 %	68 %	35 %
The degree of automation/use of sophisticated technologies[a] (%)	40 %	54.5 %	26.3 %	45.5 %	36.8 %

(continued)

Table 5.5 (continued)

		Industry		Size	
Indicator	All firms	Chemical	Metal	Large	Medium
Dependence on foreign technology[b] (%)	90 %	96 %	84 %	91 %	90 %
Share of firm providing training (%)	23 %	32 %	8 %	24 %	22 %
Incidence of external schooling effect (%)	95 %	95 %	94 %	94 %	95 %

Source: Own calculation based on the Firm Survey (2002)

[a]We measure the degree of automation/sophisticated technologies qualitatively, we asked firms about their own appreciation or evaluation of the level of technologies they are using in their production

[b]We measure the dependence on foreign technologies qualitatively, we asked firms if they have an adequate capacity/ability to produce and develop local technologies and if they have purchased equipment, machines and techniques from abroad. Our definition also include quantitative measurement of the value of imported capital equipment to total capital equipment, the percentage value of capital equipment to total capital equipment that has been build by foreign companies. Finally technology transfer is also an indicator of dependence on foreign technologies – see Table 5.7 below

(87.5 %) of the respondents firms with R&D activities have a low number (1–5) of full time research employees. Only two of the large chemical firms have more than 11 full and part-time research employees and only one large metal firm has 6–10 part time research employees. For instance, the contribution of research units in adapting the imported technologies is constrained by a shortage of skilled and qualified workers amongst 86 %, 82 %, 100 %, 80 % and 89 % of all firms, chemical, metal, medium and large firms respectively, see Table 5.8 below.[23] Moreover, the follow- up interviews with the officials and firms managers revealed that R&D activities are constrained by several factors such as high costs and low public and private spending, lack of information systems, and the absence of a R&D culture due to inadequate awareness and concern. Additional constraints relate to the poor coordination between the institutions engaging in R&D activities, either due to the absence of explicit government policy or the ineffective role of a central body (e.g. government) to coordinate and promote R&D efforts and motivate collaborative research efforts between the firms sector and university sector. In addition to weak network systems, R&D efforts, in particular, are limited across

[23] We measured the contribution of a research unit to adapt the imported technologies qualitatively, by asking firms how the research unit contributed to adapting imported technologies. In addition to a lack of qualified workers, there may also be other factors such as a lack of incentives or pressure to adapt or master imported technologies as firms can always opt to buy the required technologies or techniques.

firms because of weak contact and collaboration with the university sector, this is probably attributable to the fact that the university sector is lacking resources or concern and interest to conduct joint research with the firms sector.[24]

Moreover, Table 5.5 above shows the weak technology output indicator as measured by patent applications. For instance, in the year 2001, only 13 % of all respondent firms applied for a patent; the low degree of patenting may be attributable to low R&D efforts.

In addition, a lack of R&D efforts may hinder innovative activities across firms. The increasing uses of technology has encouraged the incidence of product and process innovations, in particular, the incidence of incremental product innovation, namely, improvement of product quality amongst 88 % of all respondent firms. It has also encouraged the incidence of new process, new method of production and new combination of old output and new product.[25] But it has only slight effect on reducing total costs and increasing total sales and total profits – see Table 5.6 below.[26]

5.2.3.3 Dependence on Foreign Technology

From the demand perspective, the results of the firm survey can be used to argue that the dependency on foreign technology leads firms to demand and rely heavily

[24] This can also be interpreted as a lack of demand-pull since firms can buy all technologies or techniques. Our findings are consistent in some respects with the findings of Haan (1999) "R&D capacity in the UAE is presently very limited. While some research is taking place at the University and other institutes of higher education, it is -as usual in such institutions- more geared towards pure science and tend to have only limited relevance for the productive sector. While the Higher Colleges of Technology place emphasis on more practical training, hardly any R&D takes place, only as a by-product of the training. Within the private sector in the UAE likewise very few R&D activities are going on. Most manufacturing and other firms tend to rely on imported technologies (both in terms of hardware and software), as well as imported materials and even expatriate manpower. There is very little interest in carrying out research, and the R&D activities are small-scale in nature and mostly only concern -minor- adaptations to the companies' own products. In all it is estimated that less than 1 % of turnover is used for this purpose. The parastatel sector, in which a number of large basic industries are operating, will do better. There is also some agricultural research ongoing. Without such R&D facilities and efforts, the UAE is almost completely dependent on imported technologies. And without the necessary adaptations to local conditions (e.g. temperatures, effects of dust and sand winds, special cultural aspects, the country's socio-political system, etc.), even these technologies cannot be optimally applied. Moreover, a genuine technology culture to motivate the involvement in R&D and promotion of local technology is now absent in the UAE. The UAE society is geared more predominantly to non-technical education, training and employment. Technical qualifications and occupations are not rated very high by its social values and cultural traditions. The UAE only has a limited industrial tradition (e.g. trade), and lacks explicit policies to stimulate and direct technological development" (Haan, pp. 37–38).

[25] As reported by 73 %, 69 %, 69 % and 62 % of all respondent firms respectively.

[26] The terms new product and new process refers to new products and processes intended even just for local firm or for local market and not necessarily for the international market.

Table 5.6 The effects of increasing use of technology product and process innovations across firms in the UAE, 1999–2001

		Firm industry		Firm size	
Product/process innovation (1999–2001)	All firms	Chemical	Metal	Medium	Large
Improvement of product quality	88 %	88 %	90 %	100	82 %
Production of a new method of production	69 %	63 %	80 %	78 %	65 %
Production of a new combination of old output	69 %	75 %	60 %	78 %	65 %
Production of a new process	73 %	75 %	70 %	67 %	76 %
Production of a new product	62 %	63 %	60 %	44 %	71 %
Production of new organizational method	58 %	50 %	70 %	44 %	65 %
Improvement of training within the firm	50 %	44 %	60 %	44 %	53 %
Improvement of communication within the firm	54 %	50 %	60 %	44 %	59 %
Production of more output with low cost	58 %	50 %	70 %	56 %	59 %
Production of the same output with low cost	38 %	38 %	40 %	56 %	29 %
Open of a new market	46 %	44 %	50 %	33 %	53 %
Reduction in per unit material costs	27 %	25 %	30 %	33 %	24 %
Reduction in per unit energy costs	27 %	25 %	30 %	33 %	24 %
Reduction in total cost	35 %	25 %	50 %	44 %	29 %
Increase in total sales	38 %	19 %	70 %	33 %	41 %
Increase in total profit	27 %	6 %	60 %	33 %	24 %
Total response	26	16	10	9	17

Source: Own calculation based on the Firm Survey (2002)

on low skilled workers. On the other hand, from the supply perspective, the deficient educational and training system and a high supply of low skilled foreign workers lead to low skill levels, lack of knowledge transfer and low capability to build and promote the local technology. The results of the firm survey show that this condition leads to weak technology indicators and dependence on imported technology that appears from the following: (1) The high dependence on the imported equipment, machines and techniques among 90 % of the respondent firms. (2) The high percentage value of capital equipment to total capital equipment that has been built by foreign companies (70 %) among the respondent firms. (3) The considerable percentage value of imported capital equipment to total capital (40 %) among the respondent firms in the year 2001. (4) The short run plan for 46 % of the respondent firms is based/depends on imported technology.[27] The main reasons for the dependence on foreign technology are the lack of local technology from local suppliers, better price and better quality of foreign technology in that order.[28] Due to the high dependency on imported technologies, it is not surprising that the level of technology used is similar to international standards amongst all the respondent firms. However, a high degree of automation through the use of sophisticated and advanced technology is limited only within 40 % of all the respondent firms- see

[27] Short, medium and long run refers to next 3 years, next 3–5 years and next 10 years respectively.

[28] As reported by 84 %, 37 % and 34 % of the respondent firms respectively.

Table 5.7 The channels of technology transfer and their effects on firm production and development of local technology across firms in the UAE, 2002

	All firms	Chemical	Metal	Medium	Large
(a) Channels of technology transfer (1999–2001)					
Strategic alliance	42 %	33 %	57 %	43 %	42 %
Hiring foreign skills/technologically advanced workers/consultants	32 %	42 %	14 %	43 %	25 %
Joint ventures	32 %	25 %	43 %	43 %	25 %
FDI	21 %	33 %	0	29 %	17 %
Licensing	16 %	8 %	29 %	14 %	17 %
Others (e.g. in house technology development by hiring technologically advanced persons)	8 %	8 %	0	0	8 %
Total response (1999–2001)	19	12	7	7	12
(b) The effects of technology transfer in (1999–2001)					
Enhancing firm production	87 %	72 %	47 %	77 %	50 %
Enhancing the capacity to develop the local technologies	48 %	44 %	20 %	38 %	30 %
Total response (1999–2001)	23	18	15	13	20
(c) The effects of technologically advanced workers in					
Enhancing firm production	47 %	63 %	29 %	50 %	45 %
Enhancing the capacity to develop the local technologies	33 %	26 %	41 %	25 %	40 %
Total response (1999–2001)	36	19	17	16	20

Source: Own calculation based on the Firm Survey (2002)

Table 5.5 above. The degree of automation/sophisticated use of advanced technologies is determined by both firm size and industry/activity.[29]

The dependence on foreign technologies also appears from the reported information on the transfer of foreign technology that is made through different channels. For instance, Table 5.7 below illustrates that strategic alliances, hiring foreign skills/technologically advanced workers/consultants and joint ventures are more common channels of technology transfer, while FDI and technology licensing are less preferred channels. The transfer of technology, mainly the transfer of technologically advanced workers/consultants, has induced important effects in enhancing firm production but has had only slight effects in enhancing the capacity to develop the local technologies.[30]

[29] These results are consistent with the findings of El Sabaa (1997) "The adoption of different approaches in transferring technology differs according to certain criteria, such as: the scale of industry and its activity. Large size and some specific sectors, namely chemical and petrochemicals industries have better use of sophisticated advanced technologies" (El Sabaa, pp. 21–22).

[30] These results are consistent in some respects but differ in others with the findings of El-Sabaa (1997) and Haan (1999) respectively. "The major channels of technology transfer are: joint ventures, and industrial foreign projects, the latter accounts for the first source of technology transfer. The turn-key

In the firm survey questionnaire the question on the channels of technology transfer allows for multiple answers, assuming that firms may choose more than one channel to transfer technology.[31] Our results indicate that chemical firms are less interested in transferring technologies through formal licenses. These may not be often requested, probably because of more liberalized and open market policies that led to considerable presence of foreign capital investment and allowed for foreign and mixed ownership – cf. Table 6.1 Chap. 6 below.[32]

These findings on weak technology indicators and dependence on foreign technologies at the micro level are consistent with those at the macro level and the interaction of these findings lead to a large technological gap – see also our earlier discussion in Chap. 2 above. Our results in this chapter and Chap. 2 above verify the second hypothesis in Scheme 1.1 in Chap. 1 above that, in the short and medium term, the Gulf countries are unable to rely on local technologies and remain heavily dependent on foreign technologies.

Our findings from the firm survey show that both skill and technology indicators, product and process innovations, the channels of technology transfer and their

projects are preferred channel of technology transfer in the Gulf region mainly because of the keenness to avoid defects of execution and to guarantee the maximum consistency of the project's design, lines of production, quality of the products, facilities of training, etc. But it has very limited role in transferring technology to local industry, because it is confined to their plants, with no minimum leakage allowed. Thus they contribute nothing to implant advanced technologies in the country. Technology transfer to the UAE has obviously contributed to accelerating industrial and economic growth, elevating the standard of national products both quality- wise and quantity-wise. In particular, the transfer of technology contributed to rapid growth of local industrial sector. However, a number of negative factors are still adversely affecting the transfer of technology, the technologies transferred could hardly approach its target of constituting an autonomously developing local technological base, similar to those in the Far East industrial countries. Because of: the inadequate awareness of the end target of technology transfer, the lack of a constitutional framework or comprehensive plan for transferring technology, the insufficient local base of technological data, the lack of qualified local manpower necessary for transferring technology and the contracts of technology transfer" (El Sabaa, pp. 23–26)."..... The UAE is almost completely dependent on imported technologies. And without the necessary adaptations to local conditions (e.g. temperatures, effects of dust and sand winds, special cultural aspects, the country's socio-political system, etc.), even these technologies cannot be optimally applied" (Haan, p. 38).

[31] Our assumption and respective findings are plausible and consistent with the results of El Sabaa (1997), which indicate numerous different channels of technology transfer to the UAE, such as: foreign industrial investments, offset programs, training missions, technological imports, industrialization licenses, patents, technological products, foreign manpower and industrial consulting offices (El Sabaa, p. 26).

[32] For instance, Fasano (2002) indicates that other than Abu Dhabi, the emirates have established free zones that allow 100 % foreign ownership of companies. These zones are particularly important in Dubai, where they have attracted a large number of foreign companies (Fasano, p. 331). El Sabaa (1997) finds that the adoption of open market philosophy, supported by the existence of nine free zones in the seven emirates and the advantage of 100 % foreign ownership and control, encourages foreign industrial investors to set up their projects and to promote technology transfer to the UAE (El Sabaa, p. 23).

respective effects vary enormously across firms and seem determined by both firm size and industry level. For instance, Table 5.5 above shows that skill levels, technology input–output indicators (R&D and patent), the provision of training (upskilling), the dependence on imported technology, the degree of automation and the use of sophisticated and advanced technology vary across firms and increase with firm size and industry level. Moreover, the use of ICT and provision of ICT training increase with firm size, while the transfer of knowledge/external effects of schooling increase with industry level.

5.2.3.4 Shortage of Skilled Workers and Weak Adaptation of Imported Technologies

From the demand perspective, the results of the firm survey can be used to argue that low supply of skilled workers lead firms to demand and rely heavily on low skilled workers. On the other hand, from the supply perspective, our findings show that the excessive share (supply) of low skilled foreign workers and low supply of high skilled workers lead to some shortage of skilled workers, since firms are experiencing increasing demand for skilled workers, see Fig. 5.1 below. We find that the increasing demand for high skilled workers is related to increasing use of new technologies, which has not only raised the demand for these workers in the past few years, but has also encouraged firms to predict a future/long run increase in this demand. For instance, Fig. 5.1 identifies and compares past and future trends of the demand for skilled workers, which vary enormously across firms according to size and industry level. According to 61 % of the respondent firms, the interpretations of the predicted long run increase in the demand for skilled workers are related to expansions of production, project plans, increasing R&D activities, implementation of new processes, output technologies, advanced control systems and purchases of new machines and equipment. Additional reasons for the rising demand are the increasing adoption of international standards and enhancement of production, product diversification, market share, turnover, sales, shortage of manpower, competition, increasing motivation to reduce costs, increasing production, achieving high standard precision work and improving productivity and quality of work and demand for more specialized skills in IT. On the other hand, the major explanations for the predicted long run stability in the demand for skilled workers across 39 % of all respondent firms is related to the stability in quantity of production, sales, business, demand and market; as well as to the lack of a plan for critical expansion of product operations, potential stability in substituting and replacing the outgoing skilled worker in any field, the use of automated technology and the dependence on the policy of parent company-MNC and its affiliated research group.

We observe that the expected future rise in the demand for high skilled workers across firms is reasonable since increased use of skilled workers in the past has had significant effects. In particular, there have been improvements in firm production, the level of competitiveness in the local market, faster adaptation of foreign

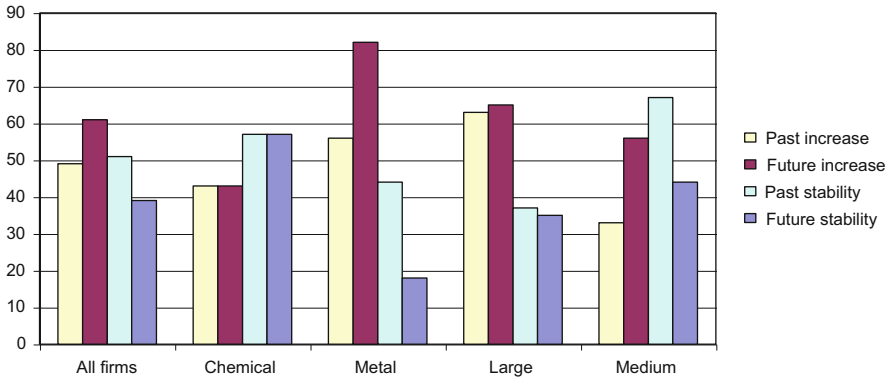


Fig. 5.1 Past and future trends (increase or stability) in the demand for skilled workers across firms (Source: Firm Survey (2002))

technology, utilization of technology and product quality.[33] On the other hand, our results from the firm survey indicate that the relative shortage of skilled workers amongst 32 % of the respondent firms leads to serious delay, slight abolishment/cancellation of project implementation and constrains the R&D units in adapting imported technologies – see Table 5.8 below.[34]

Our analysis of the shortage in skilled workers is based on the economic interpretation and definition of 'skilled shortage' as scarcity or lack of sufficient skilled workers needed, mainly because the supply of skills (as shaped by systems of education and training) has not responded fully to the rising demand across firms. However, managers may have a different interpretation and understand this as a lack of sufficient skilled workers in conjunction with wages constraints, due to limitations on their ability to pay higher wages for the high skilled workers they demand. This may constitute a limitation and appropriate caution should be exercised in interpreting our results with respect to skilled shortage, mainly because the firms answered the questionnaires do not really make it very clear how they have perceived the shortage of skilled workers and their further consequences.

5.3 The Impacts of Skill Upgrading and Technological Upgrading: Micro–Macro Views

In view of the above findings and our results in Chap. 2 above on poor skill and technology indicators, it is therefore essential to recommend further incentives to upgrade both skill and technology levels at both micro and macro levels. From that

[33] As indicated by 90 %, 90 %, 80 %, 75 % and 60 % of the respondent firms respectively

[34] As indicated by 43 %, 15 % and 86 % of the respondent firms respectively.

Table 5.8 The shortage of skilled workers and effects across firms in the UAE, (1999–2001)

Shortage of skilled workers and effects on firm projects	All firms	Chemical	Metal	Medium	Large
Shortage of skilled workers	32 %	19 %	47 %	16 %	47 %
Effects of shortage of skilled workers on firm projects					
Serious delay of firm project	43 %	31 %	63 %	50 %	38 %
Abolishment/cancellation of firm project	15 %	16 %	13 %	0	23 %
Constrained the R&D units to adapt the imported technologies	86 %	82 %	100 %	80 %	89 %
Total response	21	13	8	8	13

Source: Own calculation based on the Firm Survey (2002)

Table 5.9 The effect of upskilling plan and technological upgrading across firms in the UAE, 2002: micro view

	All firms	Chemical	Metal	Medium	Large
(a) Upskilling plan and its impacts, self-reliance strategy					
General Upskilling plan	55 %	48 %	65 %	47 %	63 %
Upskilling plan specially for national workers	19 %	21 %	17 %	10 %	27 %
Self-reliance strategy: special training programs for upskilling national workers	52 %	59 %	42 %	40 %	64 %
Self- reliance on national skills	15 %	17 %	13 %	11 %	20 %
(b)The effect of general upskilling on					
Enhancing firm production	96 %	92 %	100 %	90 %	100 %
Facilitating effective utilization and upgrading of technologies	73 %	61 %	87 %	67 %	80 %
Hiring more skilled national workers	48 %	62 %	33 %	50 %	47 %
Upskilling national workers in the firm	48 %	54 %	42 %	50 %	47 %
Reducing future demand for foreign workers	52 %	58 %	44 %	40 %	64 %
Reinforcing the employment of national skill workers	36 %	33 %	40 %	33 %	40 %
(c) The effects of technological upgrading in					
Enhancing firm production	89 %	90 %	88 %	89 %	90 %
Raising skill level	79 %	81 %	76 %	78 %	80 %
Reinforcing firm ability to promote the local technology	68 %	62 %	76 %	61 %	75 %
Total response	38	21	17	18	20
Upskilling national workers in the firm	45 %	47 %	43 %	40 %	50 %
Hiring more national skill workers	48 %	58 %	36 %	33 %	61 %
Total response	25	13	12	10	15

Source: Own calculation based on the Firm Survey (2002)

perspective, our findings in Table 5.9 below show that at the micro level the upskilling plan amongst 55 % of the respondent firms induced significant effect in enhancing firm production and facilitating the effective utilization and upgrading of technologies. But it has only a slight effect on restructuring the imbalances of labour market via hiring more skilled national workers, upskilling national workers

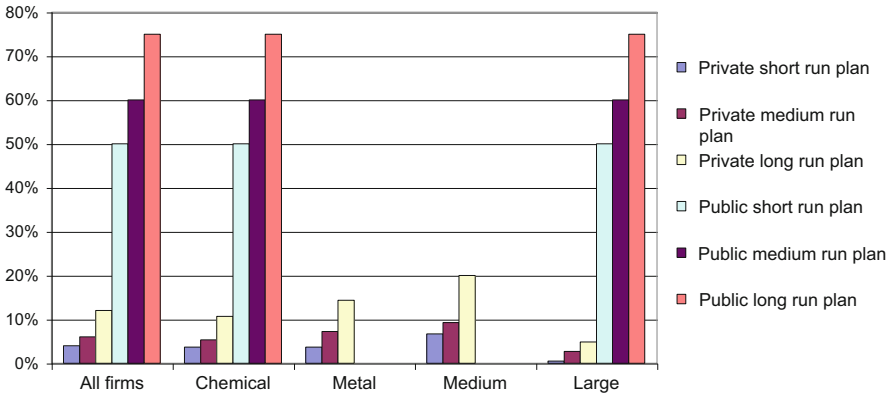


Fig. 5.2 Short, medium and long run plans of self- reliance on national skills across public and private firms *(*Source: Firm Survey (2002))

in the firm, reducing future demand for foreign workers and reinforcing the employment of national skills. Moreover, technological upgrading induced significant effects in enhancing firm production, raising skill levels and reinforcing firm ability to promote the local technology, but it has only a slight effect on both upskilling and hiring more skilled national workers.

At the micro level, Fig. 5.2 below compares the plans of public and private firms to depend on national skills. It predicts a great disparity between private and public firms that appears from the potential strong commitment to rely on national skills in the short, medium and long run plans in the large public firm. While our results from the firm survey and Fig. 5.2 below show that managers of private firms have a somewhat pessimistic view regarding the self-reliance on local skills and the potential role of both technological upgrading and upskilling in reinforcing the self- reliance strategy. For instance only 19 % of the respondent firms provide special training programmes for upskilling national workers and only 15 % of the respondent firms have plans to rely on national skilled workers even in restricted fields. Amongst all the respondent private firms the plan for depending on the national skills over the long run will not exceed 20 % of the total skilled workers.

In strong contrast to the above view, the macro survey shows that the respondent policy makers and experts are highly optimistic regarding the interactions between technological upgrading and upskilling and their roles in reinforcing economic growth, self-reliance on local skills and restructuring the labour market at the aggregate/macro level. For instance, Table 5.10 below shows that all the respondent policy makers and experts predict strong linkages between both upgrading of technology and upskilling of labour force to reinforce each other and to have a similar effect on reinforcing the self-reliance strategy and reducing unemployment rate. The official view predicts that the effect of upskilling is stronger than the effect of technological upgrading in both reinforcing economic growth and solving the imbalances in the labour market and so reducing the future demand for foreign skilled workers.

Table 5.10 The effects of technological upgrading, skill upgrading at the aggregate level in the UAE, 2002: macro view

The effects of technological upgrading	%	The effects of skill upgrading	%
Enhancing/accelerating upskilling	100	Enhancing/accelerating technological upgrading	100
Increasing/reinforcing economic growth	96	Increasing/reinforcing economic growth	100
Reinforcing self-reliance strategy	89	Reinforcing self-reliance strategy	89
Solving the imbalances in the labour market: reducing the future demand for foreign skilled workers	86	Solving the imbalances in the labour market: reducing the future demand for foreign skilled workers	93
Reducing unemployment rate	82	Reducing unemployment rate	82

Source: Own calculation based on the Macro Survey (2002)

This contradicting optimistic-pessimistic views at the macro and micro levels, regarding the self-reliance on local skills and the role of both technology and upskilling in reinforcing it, imply that the self-reliance strategy is probably a preferred government strategy, but not necessarily favoured by firms. This is consistent with the observation that 96 % of the respondent firms are private firms dominated by foreign workers and probably lack the incentives/interests to rely on national workers, mainly due to low skill and high salary requirements – see also our earlier discussion in Chap. 2 above. The respondent firms, which are costs minimizers/profits maximizers, are probably willing to continue hiring cheap readymade skilled foreign workers instead of hiring, training and upskilling expensive national workers.

5.4 Conclusions

This chapter uses the results of the macro and firm surveys to show the interaction between the deficient educational system and the high incidence of unskilled foreign workers and their implications.

Our results confirm a part of the second hypothesis in Scheme 1.1 Chap. 1 above: that in the short and medium term, the Gulf countries are unable to rely on local skills and local technologies and remain heavily dependent on both foreign skills and foreign technologies at the micro level. The major reasons are low levels of both skill and technology due to the deficient educational system and the high incidence of unskilled foreign workers and their implications.

On the one hand, from the demand perspective, the results of the firm survey can be used to argue that firm demand for low skilled workers, weak technology indicators and dependency on foreign technology led firms to demand and rely heavily on low skilled workers. On the other hand, from the supply perspective, our findings in Sect. 5.2 show that the deficient educational system – due to low quality

of education – and the excessive share of unskilled foreign workers led to low skill levels, poor provision of training, serious skills mismatch, weak linkages, lack of a networks and hindered the transfer of knowledge. These factors interacted with each other and led to poor technology indicators, poor indigenous capability to build the local technology and a heavy dependence on foreign technology. These results prove hypotheses 3.a and 3.b in Scheme 1.1 in Chap. 1 above concerning the low skill and technology indicators at the micro–macro levels: the serious implications of the interaction between the causes and consequences of the deficient educational system and the high use of unskilled foreign workers. We confirm hypothesis 3.c. in Scheme 1.1 in Chap. 1 above that the major causes of low level of local technology are low/a lack of R&D activities due to a lack of skills, transfer of knowledge, networks and collaborations between universities and industry/firms.

Our findings show two surprising contradicting macro–micro views. The first contradicting optimistic – pessimistic micro and macro views regarding the incidence and success of knowledge transfer/external schooling effect implies that, probably, the transfer of knowledge/the external effects of schooling is successful within firms but is unsuccessful within society at large. This is probably because the transfer of knowledge is hindered by: low quality of education; the weak linkages and lack of networks between universities, colleges, technical and training institutes and the productive sectors; and the imbalanced structure of population and labour market. We show that the major cause behind the low transfer of knowledge/external schooling effect is low educational qualifications, and deficient educational and training systems. The major consequences are the lack of networks and collaboration between universities and firms, low R&D efforts and low technology indicators. These results prove part of the sixth hypothesis in Scheme 1.1 in Chap. 1 above with respect to the failure and the factors hindering the transfer of knowledge/external schooling effect at the macro level. But, on the other hand, our findings surprisingly reject a part of the sixth hypothesis in Scheme 1.1 in Chap. 1 above concerning the failure of the transfer of knowledge/external schooling effect at the micro level.

Our observation of the second contradicting optimistic-pessimistic macro and micro views concerning the self-reliance on local skills, and the role of both technological upgrading and upskilling in reinforcing it, implies that the self-reliance strategy is probably a preferred government strategy, but is not necessarily one followed by private firms. Driven by profit-maximizing considerations, private firms are likely to continue in hiring cheap readymade skilled foreign workers rather than hiring, training and upskilling expensive national workers. From these observations, our results reject hypothesis 8.c. in Scheme 1.1 in Chap. 1 above about the consistency of upskilling and transfer of knowledge at the macro–micro levels.

References

Abdelkarim, A. & Haan, H. (2002, January). *Skills and training in the UAE: The need for and the dimensions of institutional intervention* (Policy Research No. 5). Dubai: Centre for Labour Market Research and Information.

Cowan, R., Soete, L., & Tchervonnaya, O. (2001). Knowledge transfer and the services sector in the context of the new economy. *MERIT-INFONOMIC research memorandum* 2001–021 (p. 9). Maastricht: Maastricht University.

El Sabaa, S. (1997). Linking technology to industrial development in the United Arab Emirates. *Trade and Industry Magazine, 22*(263), 16–29. Dubai, UAE.

Fasano, G. (2002, October 21). *With open economy and sound policies, U.A.E. Has turned oil "curse" into a blessing* (IMF Survey) (pp. 330–332). Washington, DC: International Monetary Fund.

Firm Survey. (2002, April). *Technological change and skill development: A comparative study of chemical and metal medium and large scale enterprises in the UAE*. UAE: Firm Survey.

Gray, L. (1999, April). *Private sector training and employment: Evaluation and intervention strategies* (Specialist Rep. No.4- Dubai). Dubai: The Ministry of Labour and Social Affairs National Strategy for Labour Force Development and Employment Project.

Haan, H. (1999, January/March). *The UAE: Assessment of technology use in some selected sectors- towards introduction and explaining capital and skill intensive technologies* (Specialist Rep. No. 6). Dubai/Amsterdam: National Human Resources Development and Employment Strategy Project.

Macro Survey. (2002, April). *Skill creation, human resources development and policy intervention: Interviews with policy makers and experts in the UAE*. UAE: Macro Survey.

The UAE Ministry of Economy. (1985). *The UAE population census data (1985)*. Abu Dhabi, UAE: UAE Ministry of Economy.

The UAE Ministry of Economy. (1995). *The UAE population census data (1995)*. Abu Dhabi, UAE: UAE Ministry of Economy.

The UAE University. (1994). *The UAE Education Assessment Report*. Al-Ain: The UAE University.

The UAE University. (1997). *Private sector employment and labour market in the UAE*. Al-Ain: The UAE University.

UNDP. (2002). *Human Development Report (2002): Deepening democracy in a fragmental world*. New York/Oxford: UNDP/Oxford University Press.

UNDP. (2003). *Human Development Report (2003): Millennium development goals: A compact among nations to end human poverty*. New York/Oxford: UNDP/Oxford University Press.

UNDP. (2004). *Human Development Report (2004): Cultural liberty in today's diverse world*. New York/Oxford: UNDP/Oxford University Press.

Ziesemer, T. (2004). Multiple-steady-state growth models explaining twin-peak empirics? In G. Grözinger & A. van Aaken (Eds.), *Inequality: New analytical approaches* (pp. 145–168). Marburg: Metropolis- Verlag.