Employment of Highly Educated Labor Force in Iran: Challenges and Prospects Through the Sixth Development Plan and Beyond

Gholamali Farjadi, Alireza Amini, and Pooya Alaedini

Introduction

A dominant feature of Iran's industrial development framework over the past four decades has been an emphasis on import substitution to meet the domestic demand. Government protection has been provided to firms unconditionally through import tariffs and non-tariff barriers, while the incentive structure has paid little attention to the development of capabilities. The policy framework has either resulted in suboptimal production scales or has promoted resource-based, capital-intensive, and energy-intensive production—such as petroleum derivatives, petrochemicals, basic metals, and non-metallic minerals. Similarly, Iran's exports have been realized through products relying on cheap natural resources rather than human capital or technological progress (CAI 2015). Yet, a bulk of Iran's industrial sector has been dominated by governmental or para-governmental entities unable to upgrade their inefficient management practices (Financial Tribune 2017; Al-monitor 2016).

A related concern is that the Iranian economy has experienced "jobless growth" in recent years. This is while the country's manufacturing sector suffers from low labor productivity—likely to suggest veiled unemployment and overstaffed operations. Based on information from the Central Bank (CBI 2014), during 2006–2011, Iran's gross domestic product (GDP) grew by an average of 4% per annum, while its average annual growth rate of manufacturing value added was 5.8%. In the same

G. Farjadi (✉)
Institute for Management and Planning Studies, Tehran, Iran

A. Amini
Islamic Azad University—Tehran Central Branch, Tehran, Iran

P. Alaedini
Department of Social Planning, University of Tehran, Tehran, Iran

P. Alaedini, M. R. Razavi (eds.), *Industrial, Trade, and Employment Policies in Iran*,
https://doi.org/10.1007/978-3-319-94012-0_9

period, the annual growth rates of employment for the whole economy and the manufacturing sector were 0.07 and −2.3%, respectively (ibid.). Furthermore, as college/university enrolments and graduations have grown rapidly over the past two decades (SCI 2016d), especially in the technical and engineering fields, unemployment has permeated higher levels of education—graduate as well as postgraduate. Curiously, it has stood at twice the rate of unemployment for the illiterate population in the recent period, which has been shrinking due to improving literary rates.

Thus, the Iranian government now faces the major task of generating significantly more employment for the country's college/university graduates through appropriate economic development strategies. In fact, Iran's 2025 Vision Document (Majles 2003) calls for full employment, equal employment opportunities, and increases in the share of human capital in generating national product. Furthermore, the recently initiated Sixth Economic, Social, and Cultural Development Plan of the Islamic Republic (Majles 2017), covering the period 2016–2021, provides certain exemptions for employers hiring college/university graduates in its Article 14—as it strives to reduce the unemployment rate from the recent level of 12.6 to 8.6% by the end of the period. Notwithstanding exemptions or other hiring incentives and given the large and expanding pool of technical/engineering graduates, it is advantageous to achieve the latter by increasing the contribution of highly educated workforce to production—which in fact constitutes a target of the Sixth Development Plan. This would likely lead to the enhancement of manufacturing competitiveness, exports, and productivity with potentially longer-term positive effects on employment opportunities as well as capabilities in a broader sense.

In this chapter, we examine the employment prospects of those with tertiary-level education in Iran together with government policy challenges in checking their rising unemployment. We first discuss developments in the labor market—including the role of manufacturing in it—for college/university graduates. We then describe the Sixth Development Plan's employment policies and targets and answer two related questions—will there be an adequate supply of labor force with tertiary-level education to meet the needs of the manufacturing sector during the Plan? And will the manufacturing sector be able to absorb the bulk of the labor supply with tertiary-level education? As the answers to these questions are yes and no, respectively, we subsequently make an attempt to identify skill-intensive manufacturing subsectors with competitive advantages in Iran whose development might be facilitated by the government. The aim would be to generate employment for the growing ranks of the highly educated labor force to meet or surpass the Sixth Development Plan's targets. Yet, we suggest that generating significantly more employment in the manufacturing sector for those with tertiary-level education can only be achieved in the longer-term and a broader sense by shaping a new development and industrialization framework in Iran through a carefully crafted package of capability-oriented government policies. To begin with, promoting skill intensity across all manufacturing activities can act to increase employment opportunities for the country's highly educated labor force. Improving the quality of education and matching its curricula with labor market needs is another important means. Yet, a shift is ultimately needed in the country from activities relying heavily on natural resources and simple labor input to skill-intensive

activities under a capability-oriented, knowledge-based development framework. These and other potential initiatives are proposed in the last section before our conclusion, which subsequently sums up the chapter and its policy recommendations.

Developments in Iran's Labor Market for College/University Graduates

Muted contributions of education to the economy alongside inequality of educational opportunities have been observed for most countries in the Middle East and North Africa (see Pritchett 1999; Makdisi et al. 2007; World Bank 2007; Salehi-Isfahani et al. 2014). Using the results of Trends in Mathematics and Science Study (TIMSS) test administered to eighth-graders, Salehi-Isfahani et al. (2014) report significant inequality in learning achievements in Iran as a result of inequality of opportunities related to students' social circumstances (e.g., the availability of resources for additional tutoring). Furthermore, the focus of the educational system in Iran, similar to many other countries of the region, is on secondary and especially tertiary education. The country's public sector-dominated labor market is relatively inflexible and offers lower returns to vocational training in comparison to secondary and tertiary education (Salehi-Isfahani et al. 2009). This said, Iran's vocational training system has also grown rapidly, but its quality as well as its relationship with the job market is at best uncertain (see ILO 2005: 23–29). Overall, labor market signals are most likely distorted in favor of higher-level degrees by the government's direct hiring as well as regulations governing the labor market (Salehi-Isfahani 2002: 155).

As shown in Figs. 1 and 2, enrolments at and graduations from Iran's institutions of higher education have expanded rapidly over the past two decades. This has been especially the case for the technical and engineering fields. Figure 3 highlights the ensuing rapid pace of growth in labor supply associated with college/university graduates, while Fig. 4 indicates that these developments have been accompanied by a rise in the unemployment of this group from 4% in 1996 to around 20% in 2016. Even those with postgraduate degrees have been facing a 16% unemployment rate in the recent period, as suggested by Fig. 5.

Yet, Table 1 on the recent employment structure in Iran indicates that between 2005 and 2015 the manufacturing sector employed less than 12% of college/university graduates, while the service sector accounted for more than three quarters of such employment (with the decline in the share of service sector employment from 80.4% to 76.3% mostly attributable to government's recent attempts at checking the earlier bloating of public sector employment). As of 2016, the share of college/university graduates in total manufacturing employment remains relatively low at 16.7%, although it has exhibited an average annual growth rate of 32.9% between 2006 and 2016—increasing from 307,700 to 636,600 (SCI 2006b, 2016b).

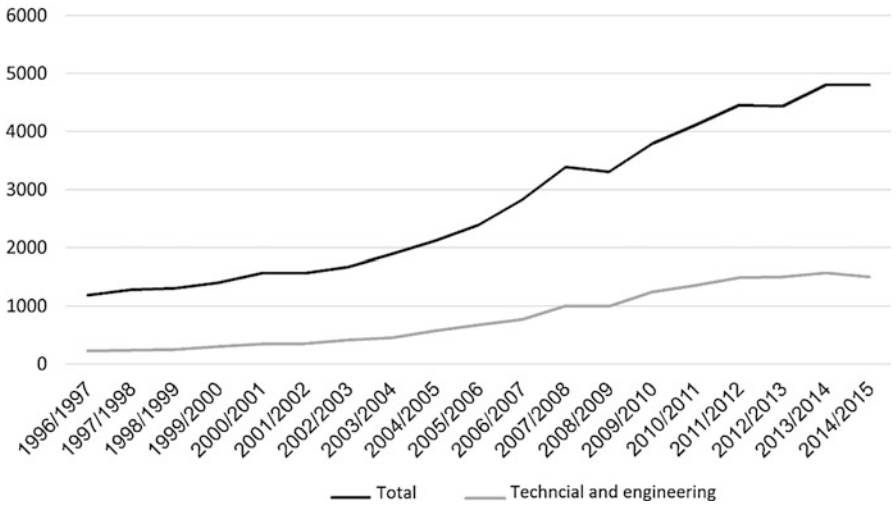

Fig. 1 Number of students in higher education, 1996–2015 (thousand persons) [Source: SCI (2016d), excel tables on higher education]

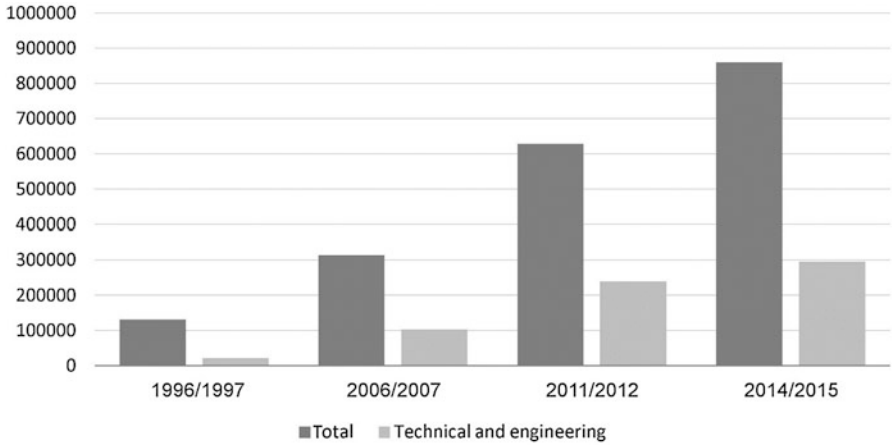

Fig. 2 Graduates from higher education institutions by field of study, 1996–2015 [Source: SCI (2016), excel tables on higher education in Iran]

Prospects for Employment of College/University Graduates in the Manufacturing Sector During the Sixth Development Plan

The labor market in Iran has undergone a curious development over the recent decades. On one hand, the high rate of unemployment has also been associated with low rates of labor force participation—especially for the youth who have opted

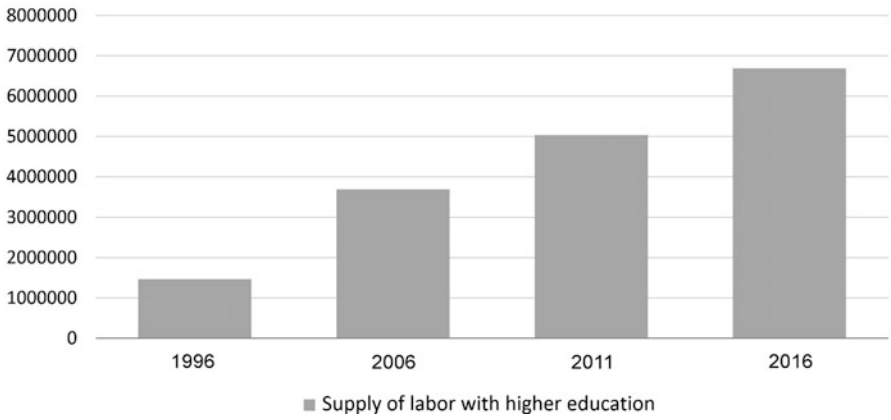

Fig. 3 Supply of labor with higher education (persons) [Source: SCI (1996a, 2006a, 2011a), Census results; SCI (2016d), Results of labor force survey]

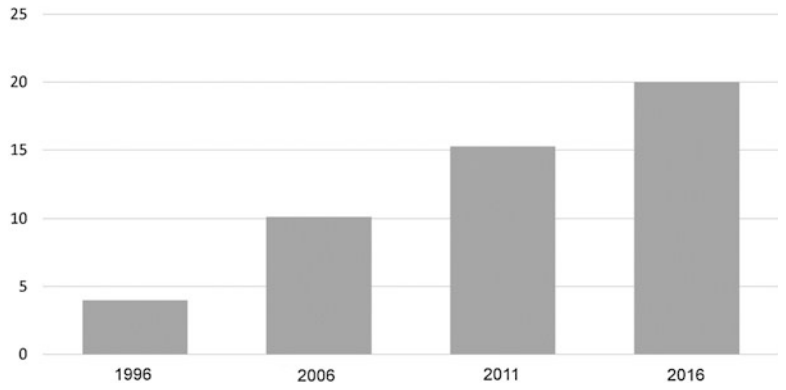

Fig. 4 Unemployment rate of labor force with tertiary education (percent) [Source: SCI (1996a, 2006a, 2011a), Census results; SCI (2016b), Results of labor force survey]

to leave the labor market temporarily to seek higher levels of education. On the other hand, higher education has expanded rapidly to accommodate this trend. This has checked the pressure on the labor market, as the rapid growth in unemployment has been delayed until the recent period. Labor force participation rate and unemployment rate grew by 1.2 and 1.4 percentage points, respectively, between 2015 and 2016. The rising pressure on the labor market as a result of the entry of college/university graduates has coincided with the Sixth Development Plan's preparation period and has attracted the attention of its policymakers. Against this background, the Plan (Majles 2017) calls for "rapid, sustainable, and employment-generating growth" in its overarching policy framework and further treats employment as priority in its Article 2. It is targeting an annual growth of 975,000 jobs in total employment in order to reduce the unemployment rate to 8.6% by 2021. This further requires an 8% GDP growth per annum.

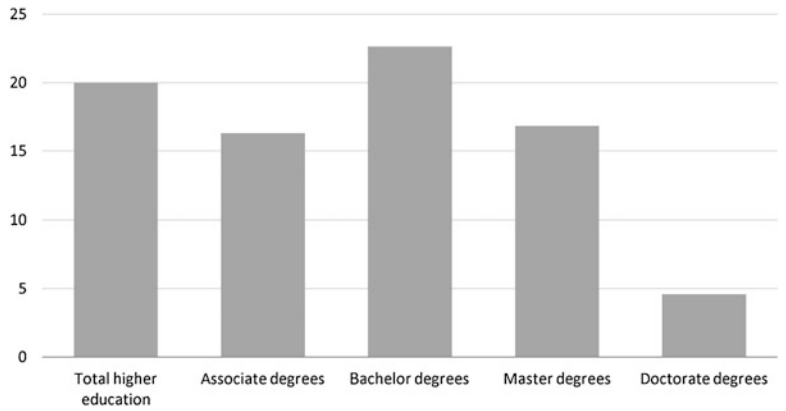

Fig. 5 Unemployment rate of college/university graduates by educational attainment, 2016 (percent) [Source: SCI (2016b), Results of labor force survey]

Table 1 Sectoral distribution of employees with tertiary education, 2005 and 2015

	Sectoral distribution (number of persons)		Sectoral distribution (percent)	
	2005	2015	2005	2015
Total	2,842,446	5,007,961	100	100
Agriculture, hunting, forestry, and fishing	77,887	145,441	2.7	2.9
Mining and quarrying	24,602	54,011	0.9	1.1
Manufacturing	288,976	598,311	10.2	11.9
Electricity, gas, and water supply[a]	52,767	112,682	1.9	2.3
Construction	112,120	276,058	3.9	5.5
Services	2,286,094	3,821,458	80.4	76.3

Source: SCI (2005b, 2015b), Results of labor force survey
[a]Includes electricity, gas, steam, air-conditioning supply and water supply, as well as sewerage, waste management, and remediation activities in 2015

Apart from the above targeting, which translates into specific allocations of resources, the Plan also calls for the preparation of guidelines on decent work that should pay attention to employment generation, skills and knowledge development, upgrading technical know-how, and protecting small-scale and home-based employment as well as preparing a plan for rural economic development and employment generation. It also stresses the use of funds released from the reduction of energy subsidies to promote production and employment, among other initiatives. The manufacturing sector is seen as a key sector in providing employment, especially for college/university graduates. Its value added and employment are supposed to grow at annual average rates of 9.3 and 3.4%, respectively, during the Sixth Development Plan. Likewise, productivity is to be raised by an average of

5.9% per annum during the Plan with implications for manufacturing firms' competitiveness and skill intensity. The Sixth Development Plan's projections for manufacturing translate into the generation of 139,000 jobs on an average annual basis so that the sector's total employment can rise from around 3,817,000 in 2016 to about 4,512,000 by 2021. Provided that average growth trends experienced during the period 2006–2016 persist through the Sixth Development Plan (based on SCI 2006b, 2016b), the share of college/university graduates in total manufacturing employment should increase from 16.7 in 2016 to 24.3% by 2021—which is the addition of 91,676 jobs annually for college/university graduates to the manufacturing sector employment.

Yet, the annual average supply of highly educated labor during the Sixth Plan will be 615,000 persons (MPO 2016). This means that the manufacturing sector will be able to accommodate only a small part of the highly educated labor. According to the statistics provided by the Ministry of Science, Research, and Technology (MSRT 2016), in the 2013/2014 academic year, 31.3% of college/university students studied in technical and engineering fields. Using the figure of 893,000 persons projected by the Management and Planning Organization to annually graduate from Iranian institutions of higher education during the Sixth Development Plan and extrapolating based on the 31.3% figure, we get 280,000 graduates per annum in technical and engineering fields—which will be well above the needs of the manufacturing sector. This means that the rest of the technical and engineering graduates must be absorbed into other economic activities, especially the service sector.

Given the above observations, the manufacturing sector should not be expected to absorb the bulk of the highly educated labor supply in the near future. Such a situation necessitates a carefully crafted plan effecting major changes in the country's economic structure and requiring a longer time period. In the short term and during the Sixth Development Plan, however, more modest steps can be taken to at least meet or surpass the Plan's targets. Indeed, to meet the goal of the Sixth Development Plan for the average generation of 91,676 manufacturing jobs per annum, additional policies are likely to be required. With this in mind, in the next section, we probe skill-intensive manufacturing activities in Iran together with factors potentially influencing skill intensity.

Increasing Skill Intensity in the Manufacturing Sector Through the Sixth Development Plan

In this section, we investigate skill intensity in Iran's manufacturing sector and its relationship with a number of important factors. The latter include those specific to each industry rather than macro-factors that are also touched upon later in the chapter. The aim here is to draw policy recommendations, especially for the Sixth Development Plan, concerning the development of skill-intensive manufacturing activities exhibiting advantage in generating employment for college/university

Table 2 Human capital in Iran's manufacturing sector

	1996	2001	2006	2011	2013	1996–2013 average
Average years of education	7.5	8.6	9.9	10.6	10.9	9.2
Share of highly educated workforce in manufacturing (%)	8	12.9	17.9	23.8	26.3	16.2

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

graduates. We use two-digit ISIC (International Standard Industrial Classification—REV. 3) data for the period 1996–2013 based on the Survey of Manufacturing Establishments with Ten or More Workers (SCI 1996c–2013c).

Table 2 provides basic information on human capital in Iran's manufacturing sector. It indicates that the average number of years of education for the workforce engaged in manufacturing establishments with 10 or more workers increased from 7.5 years in 1996 to 10.9 years in 2013. The share of employees with higher education in this category of manufacturing establishments grew from 8% in 1996 to 26.3% in 2013. These improvements notwithstanding, both figures are still indicative of low levels of human capital associated with Iran's manufacturing activities. Enhancing human capital in manufacturing and especially increasing the contribution of highly educated workforce to the sector would arguably have important implications for its international competitiveness in terms of both cost and quality. Expanding well-paying jobs for the country's growing numbers of educated youth would likely have a number of positive social consequences as well.

Table 3 sheds light on skill intensity—measured as the share of highly educated employees in the total workforce—in Iran's skill-intensive manufacturing activities for the period 1996–2013. Skill-intensive activities are defined here as those whose skill intensity is above the average for all manufacturing activities. Among the 12 skill-intensive manufacturing activities presented in the table, which employ 63% of all workers with high levels of education, the following have the highest rates of skill intensity: "manufacturing office, accounting, and computing machinery"; "manufacturing radio, television, and communication equipment"; and "manufacturing chemicals and chemical products". Developing these activities is thus expected to create the most employment opportunities for the college/university-educated labor force.

Capital versus labor intensity in a given industry is to a large extent indicative of the degree of skill intensity, as capital-intensive activities are also likely to be skill-intensive. Capital versus labor intensity of an activity may be determined by examining its share of total employee compensation in value added, that is, the share of labor in the factors of production. Activities for which this measure is below manufacturing sector averages may be considered capital-intensive. Table 4 provides information on the share of employee compensation in value added for Iran's skill-intensive manufacturing subsectors (using data on manufacturing establishments with ten or more workers). The most capital-intensive manufacturing

Table 3 Skill intensity in the most skill-intensive manufacturing activities (percent)

Subsector (ISIC two-digit categories, REV. 3)		1996	2001	2006	2011	2013	1996–2013 average
1	Manufacture of office, accounting, and computing machinery	30	41.3	41	50	56.8	44.8
2	Manufacture of radio, television, and communication equipment and apparatus	12.5	20.5	26.8	44.5	44.5	26.3
3	Manufacture of chemicals and chemical products	15.6	20.4	28.6	37.5	39.1	26.2
4	Manufacture of coke, refined petroleum products, and nuclear fuel	10	17.1	29.7	37.8	35.6	23.7
5	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	15.6	15	25	27.7	31.1	21.6
6	Manufacture of motor vehicles, trailers, and semitrailers	14	21.2	22.5	25.1	28.4	21
7	Manufacture of electrical equipment and machinery (n.e.c.)	10.8	16.5	23	30.2	31.1	20.2
8	Manufacture of basic metals	13.7	20.2	23.9	23.6	26.8	20
9	Manufacture of tobacco products	1.4	8.6	33.8	31.1	46.6	19.8
10	Manufacture of machinery and equipment (n.e.c.)	11.1	16.3	22.1	27.2	30.3	19.7
11	Manufacture of other transport equipment	6.9	15.1	6.5	30.5	33.1	19.3
12	Manufacture of fabricated metal products, except machinery and equipment	12.2	15.5	18.6	23.3	26.4	17.7
Total manufacturing		8	12.9	17.9	23.8	26.3	16.2

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

activities among the skill-intensive industries are: "manufacture of chemicals and chemical products"; "manufacture of coke, refined petroleum products, and nuclear fuel"; and "manufacture of basic metals".

Knowledge intensity in a manufacturing activity is also likely to have a positive bearing on its skill intensity, as high-tech industries are expected to employ workers with higher levels of education. To probe knowledge intensity, we can examine the ratio of research and development (R&D) expenditure to value added across manufacturing activities—the higher the value, the more knowledge-intensive the activity. Table 5 compares this value for Iran's skill-intensive manufacturing sectors. The ratio of R&D expenditures to value added for 7 out of 12 skill-intensive manufacturing subsectors is higher than the average figure for the entire manufacturing sector. These are thus considered to be both skill-intensive and knowledge-intensive.

Export orientation can be considered as another factor influencing skill intensity in manufacturing. To assess export orientation, we may examine export-to-output ratios for the skill-intensive manufacturing subsectors. Activities with export-to-

Table 4 Share of employee compensation in value added for skill-intensive manufacturing activities

Subsector (ISIC two-digit numerical codes, REV. 3)		1996	2011	2012	2013	1996–2013 average
1	Manufacture of tobacco products	0.337	0.734	0.506	0.399	0.465
2	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	0.304	0.32	0.249	0.318	0.347
3	Manufacture of other transport equipment	0.362	0.484	0.321	0.48	0.345
4	Manufacture of machinery and equipment (n.e.c.)	0.321	0.355	0.318	0.276	0.34
5	Manufacture of fabricated metal products, except machinery and equipment	0.216	0.389	0.29	0.298	0.335
6	Manufacture of electrical machinery and apparatus (n.e.c.)	0.271	0.285	0.28	0.275	0.287
7	Manufacture of office, accounting, and computing machinery	0.185	0.369	0.411	0.365	0.282
8	Manufacture of radio, television, and communication equipment and apparatus	0.2	0.28	0.239	0.139	0.267
9	Manufacture of motor vehicles, trailers, and semitrailers	0.228	0.284	0.51	0.391	0.24
10	Manufacture of basic metals	0.157	0.198	0.133	0.172	0.189
11	Manufacture of chemicals and chemical products	0.13	0.136	0.083	0.086	0.135
12	Manufacture of coke, refined petroleum products, and nuclear fuel	0.384	0.089	0.081	0.073	0.102
Total manufacturing		0.259	0.23	0.186	0.184	0.233

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

output ratios above the average for the entire manufacturing sector are considered export-intensive. This however is not a sufficient indicator for our purpose, which is identifying manufacturing activities that have the potential to generate jobs for the growing pool of college/university graduates. In this vein, an export-intensive activity is useful if its comparative advantage in producing the export item stems from human capital. That is, skill intensity would be low for an export product relying on cheap natural resources and/or unskilled workers. Table 6 compares export-to-output ratios across the 12 skill-intensive manufacturing activities in Iran. It shows that only two categories, namely, "manufacture of chemicals and chemical products" and "manufacture of basic metals" are export-intensive in addition to being skill-intensive. Yet, although some level of skill intensity is associated with these activities, both subsectors rely heavily on natural resources—raw materials and cheap energy. Furthermore, Iran's third most important non-oil export category, consisting of tannery products and leather converting, is not included in the table as it is not skill-intensive.

An additional factor potentially affecting skill intensity in a manufacturing activity has to do with scale. Larger firms are expected to employ skilled workers

Table 5 Share of R&D in value added in skill-intensive manufacturing activities (percent)

Subsector (ISIC two-digit numerical codes, REV. 3)		1996	2011	2012	2013	1996–2013 average
1	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	0.51	0.33	0.21	2.99	0.84
2	Manufacture of office, accounting, and computing machinery	0.9	0.08	0.88	0.41	0.56
3	Manufacture of motor vehicles, trailers, and semitrailers	0.45	0.54	1.05	1.22	0.52
4	Manufacture of radio, television, and communication equipment and apparatus	0.31	0.07	0.16	0.13	0.36
5	Manufacture of electrical machinery and apparatus (n.e.c.)	0.14	0.25	0.49	0.25	0.31
6	Manufacture of chemicals and chemical products	0.29	0.17	0.15	0.17	0.29
7	Manufacture of machinery and equipment (n.e.c.)	0.35	0.16	0.2	0.12	0.29
8	Manufacture of other transport equipment	0.3	0.14	0.07	0.07	0.22
9	Manufacture of basic metals	0.15	0.27	0.11	0.09	0.18
10	Manufacture of fabricated metal products, except machinery and equipment	0.08	0.14	0.11	0.1	0.17
11	Manufacture of coke, refined petroleum products, and nuclear fuel	0.08	0.09	0.05	0.05	0.08
12	Manufacture of tobacco products	0	0	0.99	0	0.07
Total manufacturing		0.2	0.22	0.19	0.21	0.24

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

at a higher rate. Scale may be measured by examining mean value added of manufacturing establishments in each subsector (dividing total value added of an activity by its number of establishments), as shown in Table 7. Subsectors for which this measure is above the average of the entire manufacturing sector may be categorized as large-scale. Seven of the 12 subsectors presented as skill-intensive in the table are large-scale as well.

It is also possible to think of scale in terms of the number of workers in an operation. As indicated by Table 8, the larger the operation in terms of the number of workers, the more likely it is to employ workers with college/university education. For example, in 2009, an average of 12.2% of workers of microenterprises (employing two or fewer employees and considered a part of industrial guilds in Iran) had tertiary-level education. The corresponding figures for medium (10–49 workers) and large (50 or more workers) establishments were 20.9 and 27.5, respectively. Although these figures are slightly smaller in 2011 and 2013, they still show a positive association between skill intensity and size of the enterprise in terms of the number of workers.

Table 6 Export-to-output ratios in skill-intensive manufacturing activities (percent)

Subsector (ISIC two-digit numerical codes, REV. 3)		1996	2011	2012	2013	1996–2013 average
1	Manufacture of chemicals and chemical products	15.62	40.37	31.95	31.54	28.6
2	Manufacture of basic metals	5.18	8.44	8.21	8.3	10.77
3	Manufacture of other transport equipment	8.37	1.46	0.43	0.49	5.22
4	Manufacture of coke, refined petroleum products, and nuclear fuel	2.94	11.89	5.71	8.92	4.68
5	Manufacture of electrical machinery and equipment (n.e.c.)	0.76	3.49	3.45	4.41	3.35
6	Manufacture of machinery and equipment (n.e.c.)	1.27	5.74	5.94	4.34	3.01
7	Manufacture of tobacco products	6.85	1.38	0.32	0.52	2.84
8	Manufacture of fabricated metal products, except machinery and equipment	1.48	2.5	3.28	3.39	2.61
9	Manufacture of motor vehicles, trailers, and semitrailers	0.6	0.91	2.75	1.25	1.25
10	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	2.21	0.64	0.63	2.2	1.23
11	Manufacture of radio, television, and communication equipment and apparatus	0.48	0.24	0.06	0.06	0.56
12	Manufacture of office, accounting, and computing machinery	0.54	0.96	0.96	0.21	0.34
Total manufacturing		4.89	12.63	10.77	11.53	8.41

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

One obvious recommendation based on the above observations would be to target skill-intensive manufacturing subsectors that exhibit competitive advantage in Iran. A policy package is required that can positively influence this subset of skill-intensive manufacturing activities. For example, supporting R&D activities can help develop the seven skill-intensive manufacturing activities in Table 5. In general, the package may include policies that promote R&D, increase production scales, grow exports, and/or enhance capital intensity for certain skill-intensive industries. Table 9 provides a summary of the characteristics of skill-intensive manufacturing subsectors in Iran, based on which a policy package for the development of skill-intensive manufacturing activities may be formulated. Except for "manufacture of fabricated metal products," all skill-intensive manufacturing subsectors have at least one of these characteristics discussed above—capital intensity, knowledge intensity, large scale of production, or export intensity.

Table 7 Average value added per establishment in skill-intensive manufacturing activities (billion rials, constant Iranian fiscal year 2011–2012 prices)

Subsector (ISIC two-digit numerical codes, REV. 3)		1996	2011	2012	2013	1996–2013 average
1	Manufacture of tobacco products	1100	1107	1006	938	1038
2	Manufacture of coke, refined petroleum products, and nuclear fuel	285	507	444	409	411
3	Manufacture of basic metals	120	157	143	153	143
4	Manufacture of chemicals and chemical products	36	152	154	154	124
5	Manufacture of motor vehicles, trailers, and semitrailers	15	120	64	51	62
6	Manufacture of radio, television, and communication equipment and apparatus	6	26	86	93	53
7	Manufacture of office, accounting, and computing machinery	3	49	46	62	40
8	Manufacture of electrical machinery and apparatus (n.e.c.)	13	39	28	25	26
9	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	7	22	20	20	17
10	Manufacture of other transport equipment	3	29	19	13	16
11	Manufacture of machinery and equipment (n.e.c.)	7	21	19	19	16
12	Manufacture of fabricated metal products, except machinery and equipment	10	16	16	19	15
Total manufacturing		15	42	40	40	34

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers

Table 8 Manufacturing workforce with tertiary education by firm size (percent)

Enterprise type by number of workers	2009	2011	2013
With 2 workers	12.2	N/A	N/A
With 10–49 workers	20.9	18.8	16.4
With 50 or more workers	27.5	25	22.6

Source: Based on SCI (1996c–2013c), Survey of manufacturing establishments with ten or more workers; ITSR (2012), summary results of the first specialized survey for measuring productivity at guild and trade units

Longer-Term Policy Initiatives to Increase Skill Intensity and Job Opportunities in the Manufacturing Sector

Over the past two decades, Iran's manufacturing sector has continued to rely on natural resources (oil and gas, minerals, and land) and use of unskilled or low-skilled labor, whereas the country's higher education system has expanded rapidly to produce ever larger numbers of graduates each successive year. As discussed

Table 9 Summary characteristics of skill-intensive manufacturing subsectors in Iran

	Skill-intensive manufacturing subsector (ISIC two-digit numerical codes, REV. 3)	Characteristics
1	Manufacture of office, accounting, and computing machinery	Knowledge-intensive and large-scale
2	Manufacture of radio, television, and communication equipment	Knowledge-intensive and large-scale
3	Manufacture of chemicals and chemical products	Knowledge-intensive, large-scale, capital-intensive, and export-intensive
4	Manufacture of coke, refined petroleum products, and nuclear fuel	Capital-intensive
5	Manufacture of medical equipment, precision and optical instruments, and watches and clocks	Knowledge-intensive and large-scale
6	Manufacture of motor vehicles, trailers, and semitrailers	Large-scale
7	Manufacture of electrical machinery and equipment (n.e.c.)	Knowledge-intensive
8	Manufacture of basic metals	Capital-intensive
9	Manufacture of tobacco products	Large-scale
10	Manufacture of machinery and equipment (n.e.c.)	Knowledge-intensive and large-scale
11	Manufacture of other transport equipment	Large-scale
12	Manufacture of fabricated metal products, except machinery and equipment	

above, the average years of schooling for Iran's manufacturing-sector workforce is barely 11 years, which is indicative of activities with low levels of technology and value added. It also reflects a mismatch between industrial and educational policies, which has resulted in a fivefold growth of unemployment for college/university graduates, as discussed. The government can opt to provide incentives to firms for employing college/university graduates. More importantly, it should change the country's industrial development framework relying on natural resources and unskilled or low-skilled labor. Inward-oriented policies and shielding domestic firms from exposure to international competition have provided little incentive to firms for enhancing their skill intensities or upgrading their technologies. A reformed structure that aims at enhancing domestic firms' competitiveness through technological upgrading and increasing use of scientific knowledge will raise their demand for hiring college/university graduates.

Table 10 compares Iran's labor productivity, export-to-output ratio, and share of R&D in manufacturing value added with those of selected OECD countries and China. Labor productivity in Iran's manufacturing sector is lower than all the countries in the table, although its smaller gap with Turkey and China hints at its potentials to catch up. Iran's situation is comparatively grave however in terms of export-to-output ratio, which is a stark indicator of the inward orientation of the country's manufacturing sector. Figures given in the table for Iran's ratio of R&D expenditures to manufacturing value added, when compared to those of the rest of the economies, are further revealing of the challenges the country's manufacturing

Table 10 Iran's labor productivity, export-to-output ratio, and share of R&D in manufacturing value added in comparison with selected economies

	Labor productivity in establishments with ten or more workers (thousand US dollars per person, PPP at constant 2011 prices)			Export-to-output ratio (%)		Share of R&D in manufacturing value added (%)	
Country	2005	2008	2010	2005	2010	2005	2010
Germany	97.3	103	104.8	67.1	65.6	8.35	9.4
UK	83.1	86.4	92.2	47.9	55.3	7.75	10.67
USA	146.7	147.4	167.2	19.3	18.7	10.26	12.87
Canada	67.5	81.1	77.9	57.8	49.1	7.32	7.05
South Korea	96.5	115.2	141	44.3	62.9	7.7	13.74
Turkey	50	49.9	N/A	42.9	45.5	0.35	0.63
China	37.6	N/A	47.8	42.5	40.9	6.59	8.71
Iran	35	40.9	45.8	12.3	13.5	0.22	0.27

Source: Labor productivity based on employment figures from ILO (2016), share of manufacturing value added in GDP from UNIDO's (2016) Statistical Country Briefs, and GDP (in constant 2011 dollars, PPP terms) from World Bank's (2016a) World Development Indicators; export-to-output ratio based on World Bank's (2016b) World Integrated Trade Solution and UNIDO's (2016) Statistical Country Briefs; share of R&D in manufacturing value added based on OECD (2013) and SCI (2005c, 2010c)

sector is facing in terms of its capacity for innovation and international competitiveness. According to the *Global Competitiveness Report* (WEF 2016), Iran is now in transition from factor- to efficiency-driven development—a stage before innovation-driven development in the three-stage model. Furthermore, based on the same report, Iran's rank among 138 countries in terms of labor market efficiency is 134, while its respective ranks for wage flexibility and productivity are 123 and 113. A related issue is the existence of a competitive environment between domestic and foreign firms, that is, an economy's degree of openness. Iran's rank in 2013 was 155 out of 157 countries covered by the *Economic Freedom of the World Annual Report* (Fraser Institute 2015) in terms of freedom to trade internationally.

Indeed, a major factor affecting skill intensity in Iran's manufacturing sector is the existence of a competitive environment fostering creativity and innovation—for which highly skilled workers would be increasingly required. Yet, although other measures focusing on the domestic market may be less gloomy for Iran, the overall situation of competition in the country is quite grim with stifling consequences for skill intensity in the manufacturing sector. Adopting an export orientation and gradually exposing domestic firms to international competition are expected to have significant positive impacts. More generally, diversifying away from oil and producing output at a much higher rate require carefully crafted macroeconomic, industrial, and accompanying social policies. Generating significant employment for those with high levels of education as well as the rest of the labor force also necessitates a well-functioning labor market as part of a dynamic economy. For this, labor market institutions must be strengthened, which needs a decentralized and at the same time a more participatory decision-making process. As an example,

flexibility of working hours associated with skilled workers in the labor market may have important implications for skill intensity in the manufacturing sector. It is often the case that small and medium enterprises need skilled workers only on a part-time basis. Flexible regulations governing the labor market for highly educated labor force may thus positively influence their employment, benefiting both skilled workers in terms of employment rate and skill intensity in manufacturing activities. Furthermore, job creation in the private sector has been stifled due to the scarcity of resources, which have moved toward the public sector and para-governmental entities. Measures can be taken to ensure adequate provision of banking credit to skill-intensive enterprises. These are likely to include innovative startups that may be micro or small enterprises (which we have not dealt with in our analysis in this chapter). Exchange rate policies have likely dampened the need for skills as well in Iran by affecting the sectoral composition of employment. There is thus a need for better exchange rate policies, efficient financial intermediation and loan selection, and more transparent public finances (see ILO 2005).

These measures will remain inadequate if the labor force does not possess skills required by the market. Despite the spectacular expansion of tertiary education in Iran, the country is ranked 85 among 130 economies evaluated in terms of Human Capital Index (World Economic Forum 2016). The index assesses both learning and employment outcomes, that is, the ability to maximize and leverage human capital endowment. Major shortfalls associated with Iran's human capital score are related to labor force participation and unemployment rates, especially for women, as well as quality of education, skill diversity, and staff training. According to figures from the Statistical Center of Iran (SCI 2016d), of the more than 11 million persons with some tertiary-level education in the country in 2013/2014, around 40% were college/university students. The likely economic inactivity of this group together with very low levels of economic participation among women brought the total number of economically inactive persons to 5.7 million in 2013/2014, while another 1.03 million persons were unemployed. Iran is also afflicted with a serious case of brain drain (Carrington and Detragiache 1999; Torbat 2002; Alaedini 2009). Furthermore, the rapid expansion of college/university enrolment—at public universities as well as proliferating private institutions—has lowered the quality of received education. Student-to-faculty ratio at Iran's public universities increased from 23.8 in 1995 (MPO 2004: 252) to 71 in 2013 (MPO 2013: 404). Per capita public expenditure on education also decreased drastically during this period (Majles Research Center 2015). Notwithstanding, Iranian higher education system has been criticized for its lack of attention to the requirements of the job market and non-practical curricula (see Hamdhaidari et al. 2008; Bazargan 2000). The nominally abundant human capital is said to lack the types of work culture required for export-led growth or working with foreign direct investment (see Odgers Berndtson 2016). There is thus a mismatch between the received education and the human capital needs of jobs that are actually or may potentially be created in various sectors of the economy. The average credentials for students have also likely declined as their total numbers have increased. It may be further speculated that high rates of unemployment for university graduates has reduced incentives for studiousness, thus lowering the average

skill profile of the graduates. The underdevelopment of university-industry relations has been highlighted as another shortcoming of Iran's higher education system by the small number of case studies available on the subject (e.g., BagheriMoghadam et al. 2012). Some related issues include the ideological content (Mehran 1990) and political screening of applicants for both higher education and employment (Habibi 1989). Thus, increasing the employment of labor force with tertiary education will further require an overhaul of the higher education system as well as developing a close university-industry relationship—including internship and apprenticeship programs.

Conclusion

We started this chapter with a discussion of labor market developments for college/university graduates in Iran and the prospects for their increased employment through the country's Sixth Economic, Social, and Cultural Development Plan. Based on estimates provided by the Management and Planning Organization, around 80% of new labor supply during the Sixth Development Plan will be associated with college/university graduates. This means that the manufacturing sector should not face any problem in finding suitable candidates for recruitment—taking into account especially the large pool of technical and engineering students and graduates in the country. Availability of labor force with quality education is likely to have a positive impact on skill intensity in the manufacturing sector, as firms will have better access to high-quality human capital. Yet, the sector will be able to accommodate only a portion of the highly educated labor supply during the Plan. Furthermore, a set of strong initiatives are needed to make sure the Plan's targets are met or surpassed. We were thus prompted to use two-digit ISIC data for the period 1996–2013 to identify skill-intensive manufacturing activities whose further development could be targeted to generate employment for the country's highly educated labor force.

Our analysis which probed various factors associated with skill intensity—including share of R&D and employee compensation in value added, export-to-output ratio, and scale—highlighted 12 manufacturing activities that together employ 63% of Iran's highly educated manufacturing workforce. Among them, "manufacture of office, accounting, and computing machinery," "manufacture of radio, television, and communication equipment," and "manufacture of chemicals and chemical products" are the most skill-intensive. Creating a supportive environment for their growth should be considered by the government. Needless to say, a more thorough analysis of various manufacturing activities within these identified subsectors—as well as other subsectors—in terms of skill intensity would allow for better targeting. In a more general sense, we suggested that firms with higher shares of R&D in value added are more skill-intensive and likely to require a highly educated workforce. Another policy target should thus comprise support for the expansion of firms' R&D activities. We further indicated that larger firms are likely to be more skill-intensive—this being true when comparing small to micro and medium to small enterprises. Incentive structures that encourage

growth of firms and mergers are thus likely to enhance skill intensity and by extension the demand for a highly educated workforce. Yet, some skill-intensive manufacturing activities are also capital-intensive and/or have higher export performance records. The government should refrain from policies that increase such firms' relative costs of capital or at least continue with its subsidized banking facilities to firms that are at the same time skill-intensive and capital-intensive. As some of the country's export industries are skill-intensive, policy initiatives to increase their exports—for example, through subsidies provided to exporters or trade facilitation—can also lead to a higher demand for college/university graduates.

Increasing employment opportunities for the labor force with tertiary-level education will additionally require enhancing skills through higher quality and market-oriented training accompanied by internship and apprenticeship programs. Yet, increasing the capacity of Iran's manufacturing sector to absorb a significantly larger part of the highly educated labor force necessitates major shifts of industrial and trade policies to move the economy from resource-based production toward export-oriented and knowledge-based activities relying on continual capability and technological upgrading. A well-functioning labor market with strong decentralized institutions must also be fostered to generate significant employment for those with high levels of education as well as the rest of the labor force. Accompanying macroeconomic measures are required as well to ensure the maintenance of an environment conducive to creation of skill-intensive employment.

Acknowledgment The authors wish to acknowledge assistance received from Alireza Farhadikia and Arash Valinia in the preparation of this chapter.

References

Alaedini P (2009) Migration dynamics of highly-skilled and semi-skilled Iranian labor force. J Popul Assoc Iran (7):87–113. http://fa.journals.sid.ir/ViewPaper.aspx?id=144401. Accessed 5 May 2015 (in Persian)

Al-monitor (24 Nov 2016) Why Iran's private sector hasn't benefited from privatization. Al-monitor. https://www.al-monitor.com/pulse/originals/2016/11/iran-privatization-private-sector-impact-pension-funds.html. Accessed 21 Nov 2017

BagheriMoghadam N, Hosseini SH, SahafZadeh M (2012) An analysis of the industry-government-university relationships in Iran's power sector: a benchmarking approach. Technol Soc 34(4):284–294. https://doi.org/10.1016/j.techsoc.2012.09.001

Bazargan A (2000) Internal evaluation as an approach to revitalize university systems: the case of the Islamic Republic of Iran. Higher Educ Policy 13(2):73–180. https://doi.org/10.1016/S0952-8733(99)00024-0

CAI [Customs Administration of Iran] (2015) Data tables for manufacturing export values. Brookings Institution Press, Washington, DC

Carrington WJ, Detragiache E (1999) How extensive is the brain drain? Finance Dev 35(2):46–49. http://www.imf.org/external/pubs/ft/fandd/1999/06/carringt.htm. Accessed 11 June 2016

CBI [Central Bank of Iran] (2014) National accounts-2006–2011. http://www.cbi.ir/simplelist/5796.aspx. Accessed 10 Sept 2014

Financial Tribune (2017, Sept 3) ICCIMA investigates failure of privatization. Financial Tribune. https://financialtribune.com/articles/economy-business-and-markets/71646/iccima-investigates-failure-of-privatization. Accessed 3 Sept 2017

Fraser Institute (2015) Economic freedom of the world—2015 annual report. https://www.fraserinstitute.org/sites/default/files/economic-freedom-of-the-world-2015.pdf. Accessed 7 Jan 2016

Habibi N (1989) Allocation of educational and occupational opportunities in the Islamic Republic of Iran: a case study in the political screening of human capital. Iran Stud 22(4):19–46. https://doi.org/10.1080/00210868908701739

Hamdhaidari S, Agahi H, Papzan A (2008) Higher education during the Islamic government of Iran (1979–2004). Int J Educ Dev 28(3):231–245. https://doi.org/10.1016/j.ijedudev.2006.11.001

ILO [International Labour Organization] (2005) An employment strategy for the Islamic Republic of Iran. Subregional Office for South Asia, New Delhi. http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-new_delhi/documents/publication/wcms_124326.pdf. Accessed 10 Feb 2016

ILO [International Labour Organization] (2016) ILOSTAT. http://www.ilo.org/ilostat/. Accessed 17 Feb 2016

ITSR [Institute for Trade Studies and Research] (2012) Kholaseh-ye natayej-e avvalin tarh-e amargiri-ye takhassosi-ye sanjesh-e bahrevari-ye vahedha-ye senfi va bazargani (Summary results of the first specialized survey for measuring productivity at guild and trade units). Research Center for Productivity Improvement (in Persian)

Majles [Islamic Consultative Assembly] (2003) Chashm-andaz-e jomhuri-e eslami-e Iran dar ofoq-e 1404-e hejri-e shamsi (2025 Vision Document of Islamic Republic of Iran). Adopted on 4 Nov 2003 and available from http://rc.majlis.ir/fa/law/show/132295 (in Persian)

Majles [Islamic Consultative Assembly] (2017) Qanun-e barnameh-ye panj-saleh-ye sheshom towse'eh-ye eqtesadi, ejtema'i, va farhangi-ye jomhuri-ye eslami-ye Iran—1396–1400 (Law of the sixth five-year economic, social plan of the Islamic Republic of Iran—2017–2021). Adopted on 5 Apr 2017. http://rc.majlis.ir/fa/law/show/1014547 (in Persian)

Majles Research Center (2015) Tahlili bar chaleshha-ye eshteghal-e danesh-amukhtegan-e daneshgahi (An analysis of challenges of employment for university graduates). Subject code: 210, Number 14168. http://rc.majlis.ir/fa/mrc_report/show/922815. Accessed 3 Jan 2017 (in Persian)

Makdisi S, Fattah Z, Limam I (2007) Determinants of growth in the MENA region. In: Nugent J, Pesaran MH (eds) Explaining growth in Middle East and North Africa. Elsevier, London, pp 31–60

Mehran G (1990) Ideology and education in the Islamic Republic of Iran. Compare 20(1):53–65. https://doi.org/10.1080/0305792900200105

MPO [Management and Planning Organization] (2004) Gozaresh-e rob'-e qarn amalkard-e nezam-e jomhuri-ye eslami-ye Iran (Report on the quarter century performance of the Islamic Republic of Iran) (in Persian)

MPO [Management and Planning Organization] (2013) Gozaresh-e amalkard-e qanun-e barnameh-ye panjom-e towse'eh dar sal-e 1392 (Report on the performance of the law of the fifth development plan in 2013) (in Persian)

MPO [Management and Planning Organization] (2016) Gozaresh-e pishbini-ye arzeh-ye niru-ye kar, eshteghal va sarmayeh-gozari-ye mowred-e nyaz dar barnameh-ye sheshom (Report on forecasting required labor supply, employment, and investment during the sixth plan). Macro-economic Bureau (in Persian)

MSRT [Ministry of Science, Research, and Technology] (2016) Amar-e amuzesh-e ali-e Iran—sal-e tahsili-ye 1393–1394 (Statistics on Iran's higher education—academic year 2014–2015) (in Persian)

Odgers Berndtson (2016) Iran's 2016 human capital conundrum. http://www.odgersberndtson.com/fr-fr/publications/iran%E2%80%99s-2016-human-capital-conundrum. Accessed 18 Jan 2017

OECD [Organization of Economic Cooperation and Development] (2013) OECD.Stat. http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV2#. Accessed 12 Dec 2013
Pritchett L (1999) Has education had a growth payoff in the MENA region? World Bank Middle East and North Africa Working Paper Series, no 18. http://documents.worldbank.org/curated/en/555731468756581481/pdf/multi-page.pdf. Accessed 7 June 2014
Salehi-Isfahani D (2002) Population, human capital, and economic growth in Iran. In: Sirageldin I (ed) Human capital: population economics in the Middle East. I.B. Tauris, London (in association with Economic Research Forum for Arab Countries, Iran, and Turkey), pp 141–161
Salehi-Isfahani D, Belhaj Hassine N, Assaad R (2014) Equality of opportunity in educational achievement in the Middle East and North Africa. J Econ Inequal 12(4):489–515. https://doi.org/10.1007/s10888-013-9263-6
Salehi-Isfahani D, Tunali I, Assaad R (2009) A comparative study of returns to education of urban men in Egypt, Iran, and Turkey. Middle East Dev J 1(2):145–187. https://doi.org/10.1142/S1793812009000085
SCI [Statistical Center of Iran] (1996a, 2006a, 2011a) Census results
SCI [Statistical Center of Iran] (1996b–2016b) Natayej-e tarh-e amargiri-ye niru-ye kar (Results of labor force survey) (in Persian)
SCI [Statistical Center of Iran] (1996c–2013c) Natayej-e tarh-e amargiri az kargahha-ye san'ati 10 nafar karkon va bishtar (Survey of manufacturing establishments with 10 or more workers) (in Persian)
SCI [Statistical Center of Iran] (2016d) Excel tables on higher education, employment, and labor force participation. https://www.amar.org.ir/. Accessed 3 Dec 2016
Torbat AE (2002) The brain drain from Iran to the United States. Middle East J 56(2):272–295 http://www.jstor.org/stable/4329755
UNIDO [United Nations Industrial Development Organization] (2016) Statistical country briefs. http://www.unido.org/en/resources/statistics/statistical-country-briefs.html. Accessed 7 Mar 2016
WEF [World Economic Forum] (2016) The global competitiveness report 2016–2017. http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf. Accessed 13 Mar 2017
World Bank (2007) The road not travelled: education reform in the Middle East and North Africa. World Bank, Washington, DC
World Bank (2016a) World development indictors. http://wdi.worldbank.org/. Accessed 8 Mar 2016
World Bank (2016b) World integrated trade solution. https://wits.worldbank.org/. Accessed 7 Mar 2016
World Economic Forum (2016) Human capital report 2016. http://www3.weforum.org/docs/HCR2016_Main_Report.pdf. Accessed 8 June 2017

Gholamali Farjadi is Associate Professor of Economics at the Institute for Management and Planning Studies affiliated with Iran's Management and Planning Organization. He mainly teaches labor economics, economic development, and macroeconomics and has served as deputy director and director of the institute. His publications include several books in Persian as well as journal articles and research reports. He has also led a number of high-profile projects on employment and labor market in connection with Iran's national planning framework. He holds a Ph.D. in economics from New York University.

Alireza Amini is Associate Professor in the Faculty of Economics and Accounting, Islamic Azad University, Tehran Central Branch, where apart from teaching he edits a Persian-language economics journal. He has served as an advisor to the Management and Planning Organization and directed the productivity assessment initiative of the Iranian Institute for Trade Studies and Research during 2014–2015. His publications include a number of journal articles in Persian on various aspects of the Iranian labor market and productivity. He received undergraduate and

graduate degrees from Shahid Beheshti University and holds a Ph.D. in economics from the Islamic Azad University in Tehran.

Pooya Alaedini is Associate Professor of Social Planning at the Faculty of Social Sciences, University of Tehran. Over the past decade, he has served as a consultant for several international development projects in the Middle East, Central Asia, and Africa. He is coeditor of *Economic Welfare and Inequality in Iran: Developments Since the Revolution* (Palgrave Macmillan, 2016) and coauthor of *From Shelter to Regeneration: Slum Upgrading and Housing Policies in I.R. Iran* (UDRO, 2014). His other publications include earlier monographs in Persian, a number of peer-reviewed articles in Persian and English, and several full-length reports produced for international organizations. He has a Ph.D. in urban planning and policy development from Rutgers University, USA, as well as graduate degrees in economics and engineering.