Israel: A large footprint in the ICT world*

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A number of ingredients have led to the emergence of Israel as a powerhouse in the information and telecommunications industry and as a country otherwise well-positioned at the center of the knowledge economy. Israel does well in the ICI, ranking 21st, placing it on a virtual par with Germany and Austria. There are a number of features behind this strong performance which are worth highlighting, including close collaboration between government and business, government encouragement and support of the capacity of the private sector to compete in international markets, heavy investment in education, an intelligent use of investment incentives (sometimes favoring foreign investors to build innovation capacity), unusually high investment in R&D, and the implementation of mutually supporting incubator and venture capital programs to convert research into cutting edge businesses. These interventions have been supported by ambitious economic and institutional reforms aimed at enhancing resource allocation and contributing to the modernization of the economy. We briefly review some of these key factors.

Education at the core

Israel has an impressive track record of human capital investment, based on a strong cultural heritage stressing excellence in education. It has several world-class institutions of higher education, including the Technion in Haifa, the Weizman Institute in Rehovot, and the Hebrew University in Jerusalem. Growing demand for higher education has been met by liberalizing higher education to allow private colleges, foreign competition, and by recognizing degrees granted by technical schools accredited by the Ministry of Education. The tertiary school enrolment rate is 60.4 percent, higher than in France, Germany, and the United Kingdom, although not as high as in the Nordic countries. Over the years there has been active collaboration between the academic establishments and the business community. For instance, in the early 1990s, industry leaders saw the need to substantially boost the number of graduates from the top universities with appropriate, cutting-edge training in electronics and computer science. This was achieved by the creation of task forces that sought to boost the science and technology component of university curricula. Israel's quite successful efforts to shift the priorities of career paths within the public university system to reflect the changing needs of industry, have contributed much to the dynamism of its high-tech sector.

Active collaboration between the universities and industry has, in turn, reflected the realization that Israeli comparative advantage resided in its qualified human capital rather than in its relatively scarce natural resources endowments. The national market was too small to sustain the emergence of national industries and the political situation precluded the growth of trade with other countries in the neighborhood. Thus, the potential market for Israeli products had to be global in scope, demanding a focus on innovative products which could be sold on international markets. Hence, a small market size and the adverse political geography served as catalysts to spur the development of an industry which ultimately would not depend for its success on these two factors. Unable thus far to tap into a plentiful extractable commodity, Israel has been forced to trade globally on its human capital endowment. The government has sought to make improvements to the system of higher education; for instance in 2007, the Shohat Committee made a number of recommendations, including increasing the distinction between universities and colleges, allowing providers greater flexibility in the setting of fees, introducing better mechanisms for financing long-term student loans, and raising teacher-student ratios. Despite some initial moves in this direction, the Committee's recommendations remain to be implemented.

Strong government support for private R&D

Israel has had a long-standing policy of subsidizing private-sector R&D projects as a way of promoting the emergence of a technologically advanced ICT sector. This has been done largely through the Office of the Chief Scientist (OCS), at the Ministry of Industry, Trade and Labor, which administers and grants government funds for R&D, on the premise that the business sector alone will not be able to sustain adequate levels of investment in research

and development projects, particularly in high-risk, albeit promising, areas.

Under existing arrangements, qualifying companies can apply for government grants normally covering between 20–50 percent of the R&D budget. If the products and processes resulting from the government-sponsored project are commercially successful, the company must pay the government back royalties, which correspond to a defined percentage of the total annual product sales. The annual budget for industrial R&D research covers an average of 1,000 projects, implemented by 500 companies. Financial support to industrial R&D has been by far the most important in terms of budgetary allocations, some US$300 million per year in recent years. Priority has generally been given to technology projects which can lead either to new products and processes, or to substantial improvements of existing ones. Areas of particular emphasis have been software, biotechnology and computing, electronics, chemical and mechanical engineering. According to the OECD, "Israel has a remarkably high level of spending on R&D: its share in GDP is greater than in all OECD countries," slightly below 5 percent (2009, p. 138).

Another innovative program, named Magnet, was put in place in the mid 1990s to strengthen the bonds between industry and the untapped first-class research capabilities of Israeli universities. Under this program, consortia of industrial firms and at least one academic institution are entitled to multi-year grants of three to five years, for up to 66 percent of the total approved R&D budget to develop pre-competitive generic technologies. The consortium commits to making the resulting technologies available to any local interested party at a moderate price. In 2005, there were 31 consortia.

The OCS has also entered into a formal mechanism of international cooperation, particularly in target commercial markets, with a view to addressing one of Israel's main weaknesses: lack of skills and expertise in international marketing resulting from the small size of the country's companies and their somewhat remote geographical location. Thus, the fostering of contacts between national and foreign companies leading to joint R&D, manufacturing, and marketing has been an important focus of government R&D policy.

Technology incubators and innovation

An overabundance of ideas has sometimes run up against the constraints of lack of funding, and successful innovation in technology requires both. The government noted early on that original research in the universities and institutes did not often lead to readily marketable industry applications. As noted above, it was the Magnet program that first sought to strengthen the avenues of collaboration between industry and the academic community. In a sense, the task for the authorities was to replicate the fairly successful integration of the know-how and specialized skills of qualified military personnel, particularly those working in the army's Computer and Data Communications Network Center, into the private sector.

In the early 1990s, to promote business start-ups, and particularly to facilitate the integration into the job market of the new wave of immigrants, the OCS initiated the incubator program. The aim of the program was to enable first time entrepreneurs with new ideas with export potential to develop them into a business. Many of the arriving immigrants had remarkable technical skills but little experience in the commercial development of innovative projects. The program sought to take selected entrepreneurs through to first round investments in product development, to the point where they could become autonomous, find strategic partners, and raise venture capital in the markets. There are currently in operation 24 technology incubators, each conducting an average of about 10 projects with an average duration of two to three years. The government provides some 85 percent of the funds in the form of grants and soft loans, with the rest funded by a venture capital firm, the incubator itself, or the entrepreneur, in exchange for a share of equity in the company. The program was so successful that by 2009, 22 of the incubators had been privatized, typically by venture capital firms, sometimes in partnership with local development authorities. A key ingredient of success has been the enforcement of strict quality control and high standards of performance—the government actively sought to ensure the commercial success of projects undertaken under the aegis of incubators, avoiding the trap, so common in other countries, of turning an initially good idea into a mere job-creation bureaucracy. The incubator program was instrumental in spawning the rapid growth of start-ups in Israel. Within a decade of the creation of the incubator program the number of start-ups had risen to 2,000, a five-fold increase, making Israel the country with the world's highest density of high-tech start-ups. By 2009, the number of start-ups had risen to some 4000. Even more impressive, the success rate of incubator start-ups—measured as the ability to raise private funding to allow the company to operate for at least two years—is 50 percent, five times higher than the corresponding success rate for start-ups in the United States. According to the OECD, "in the past decade, more than 100 Israeli start-ups have gone public on the

NASDAQ" (2009, p 140), though efforts are underway recently to encourage initial public offerings locally.

Investment incentives

The government has been quite proactive in encouraging domestic and foreign capital investment in Israel. Enterprises, whether Israeli or foreign, which were deemed eligible by the Ministry of Industry were in a position to receive government grants to finance a portion of tangible fixed assets. Furthermore, the underlying legislation actually introduced a bias in favor of foreign investors. It was thought that a combination of tax incentives and the relative abundance of engineers and scientists would boost the attractiveness of Israel as a location for high-tech multinationals. These would not only contribute to job creation in Israel, but would also bring with them know-how and the exporting channels that the local industry needed. The government's strategy worked extremely well: international investors flocked to Israel, including high-tech giants such as IBM, Motorola, and Intel, and were followed by many others. Microsoft and Cisco built their first R&D facilities outside the United States in Israel; Motorola's R&D center in Israel is its largest worldwide. In addition to creating state-of-the-art R&D centers, companies such as Intel and Motorola established manufacturing facilities, which rapidly became some of the largest private employers in Israel. More recently, concerns about emerging skills shortages and the tough credit environment in the wake of the global financial crisis—which sharply reduced the funding to high-tech companies from venture capitalists—has prompted the government to reconsider the sorts of incentives presently on offer. The aim is to continue to nurture the growth of an industry that now accounts for 40 percent of total exports and 15 percent of GDP.

Figure 5. **Israel: Significant indicators above income group average**