Israel: Of Swords and Software Plowshares

In July 1947, the Advisory Committee of the Applied Mathematics Department of the Weizmann Institute, consisting of Albert Einstein, Hans Kramer, Robert Oppenheimer, John von Neumann and Abram Pais, recommended that the Institute build an electronic digital computer [1]. Thus, Israel became the first not-yet-a-nation to seriously commit itself to computing. After a delay to get the country started, an operational WEIZAC was built by 1955. Israel has gone on to distinguish itself in scientific and computing research and education and to claim some hardware niches, notably in defense-related systems.

But perhaps the most important and dramatically growing Israeli strength in computing today is software. Between 1984 and 1992 the Israeli software industry tripled its sales and increased export by 2,700% [3]. There were approximately 150 software companies, with total sales of over $600 million in 1992 and employing about 5,500 of the nation's 12,000 computer professionals [3]; the estimate for 1993 total sales is $720 million. The extent of "pure" software export (excluding embedded software) increased from $5 million in 1984 to $110 million in 1991 [3], $140 million in 1992 and an estimated $175 million in 1993. In 1991 58% of this volume headed for the U.S. and 37% to Europe [6]. The export share of total output from Israeli software houses rose from 2.5% in 1984 to about 25% in 1993. The importance of export to a small economy such as Israel's cannot be overstated—it is the only way to maintain a world-class computing sector.

Interestingly, as of 1992-93, the Israeli software industry was again half as large as its much examined Indian counterpart, but with about three-quarters of the latter's export value [6]. Structurally, in spite of the vast differences in size of their domestic economies and population (roughly 5 million to 850 million), the Israeli software industry seems to have more of an indigenous base.

Some of the conspicuous successes of Israeli software export are "niche products," based on expertise in advanced DBMS and application generators, computer center operation.

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educational software, and antivirus protection. A different but notable form of export occurs through joint ventures or subsidiaries. A number of major global computing companies such as Microsoft (DOS 6.0’s antivirus capabilities and hard disk compression originated in Israel), IBM, Intel, National Semiconductor, and Motorola, among others, are engaged in software R&D in Israel.

Public policy with regard to the software industry takes the form of subsidies for R&D, tax incentives, and marketing support for software export. While considered by some to be a significant ingredient in the current growth, others think the government's positive attitude has taken too long to form and its impact falls short of what is required.

Israel is one of a number of little countries around the world whose energies and accomplishments in computing and other information technologies (IT) are out of proportion to their sizes and natural resources. What drives such progress in a country as small as Israel? We explored this question in a series of faculty visits and interviews with key software players in May 1993 [2]. Answers identified three categories of driving factors: circumstances that prevailed at significant points in time, the nature of the Israeli market, and some cultural attributes which affect Israel as a software developer. We discuss each in turn.

The Drivers: Historical Circumstances

The lack of administrative capabilities that marked the early years of statehood led to an attitude that was especially receptive to computing. This frame of mind was further reinforced by the view of “the few against the many” which is a widely held among Israelis. Accordingly, the history of IT in Israel started shortly after independence (1948) with the use of electromechanical machines. Therefore the development and adoption of technology was, and still is, seen as a way to maintain a qualitative edge in light of numerical inferiority.

The history of economically significant data processing and software development in Israel began in 1960 with the creation of MMRM, the computing center of the Israel Defense Forces (IDF). MMRM—commonly called “Mam’ram”—is the Hebrew acronym for the Center of Computers and Automated Recording. The center was set up around a Philco Transac 2000 mainframe, one of the earliest transistor-based computers available outside the defense establishments in the U.S., USSR and UK. With this platform, modern record keeping became part of military management for personnel and logistics. In the late-1960s MMRM replaced its original engine with an IBM 360/50 mainframe and remained technology current ever since.

At the time, and for many years, MMRM was the largest and most sophisticated computing center in the country. There has been a tremendous growth in the number of computing centers in business, higher education, and civil government in Israel over the years, which has naturally eroded MMRM’s singular position. Military computing in general has nonetheless maintained a central professional place and standing.

The unique role of MMRM in the Israeli computing milieu is manifested through commonly used linguistic coins like “MMRM graduate,” which designates its holders as belonging to an “elite clique” by virtue of their service experience. Another term is “MMRM Diaspora,” referring to MMRM graduates who were recruited by foreign companies. For instance, some leading financial companies in the U.S. list among their outstanding computing experts quite a few MMRM graduates. They are perceived to be able to quickly master complex topics (“devour many pounds of technical literature”), to select untraditional shortcuts to original solutions, and to avoid formal meetings.

Although no longer the dominant source for computing professionals in the country, MMRM’s circumstances are still distinctive. As one person colorfully expressed it: “Where else can one get a 24-year-old with six years of intensive (professional) computing experience?” MMRM soldiers are required to serve longer than the mandatory three years, but they typically complete their service and enter the market in their early-20s. Many leading hi-tech companies and computing centers in Israel have been established or are led by MMRM graduates. MMRM does represent a unifying experience of a central core of the Israeli IT community and its current leadership. The human potential which MMRM and other parts of the military (e.g., the air force and intelligence branches) helped spawn was there when the opportunities arose for the software industry to rapidly develop and expand.

In the last couple of decades, the Israeli base for software-related R&D and training has expanded considerably, most notably to include an exceptional academic community for a small country in engineering, computer science, and MIS. Notable Israeli computer scientists include Michael Rabin (1976 ACM Turing Award Laureate), Adi Shamir (the “S” in the RSA encryption system), David Harel (software engineering), among many others. Together, higher education programs annually feed the market with 500 to 700 well-educated computer professionals.

Another frequently mentioned historical circumstance is the relatively easy access to the U.S. market by Israeli enterprises. This was suggested as a crucial variable in explaining the differences between Israel’s software industry achievements as compared to, say, Cuba. Both small countries have educated and aspiring computing professionals, and both are isolated within their respective hostile environments [5]. Neither has been able to develop regional markets, but the Israelis have been much more successful in finding more distant markets, not only in the U.S. but in Europe and Asia as well.

Finally, Israel is explicitly built on Jewish immigration, which offers access to many native speakers of foreign languages, which in turn has driven some of Israel’s forays into markets abroad. Immigrants bring with them not only a strong command of the language but also an intimate knowledge of the respective cultures. For example, ex-Soviet immigrants since the 1970s have helped to set up business relations with their former employers in Russia, the Ukraine, and elsewhere.
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The Drivers: Israeli Consumers

The Israeli defense industry has traditionally been driven by its challenging local customers. Military equipment and components could be labeled as "battle tested," attesting to their functionality and quality. Several interviewees suggested that a parallel experience exists in the civilian systems market. They argued that many of the appreciated features of software made in Israel owe their existence to the typically "tough" (some might say "obnoxious and aggressive") Israeli clientele.

The typical Israeli user tries to "outsmart" the system. In one example, a domestic airline reservation system had to control the overbooking "abuses" of its users, apparently much more so than elsewhere (Israelis are notoriously aggressive travelers). The resulting system was made more robust in that respect.

Israelis are known to be "information junkies" who consume more information than many counterparts elsewhere in the world. This is manifested by the exceptional per capita circulation of newspapers, by a national "addiction" to radio and TV newcasts, as well as by the amount of information available and demanded from bank ATMs—partly a result of the past hyper-inflation period when maintaining the buying power of money, even for ordinary people, was an expensive daily exercise.

Another national trait is an acute suspicion of "apparatuses." In the realm of banking this calls for issuing an array of receipts. The on-line deposit procedure at Israel Discount Bank, for instance, involves actually reading the check at the ATM. The customer receives a more serious acknowledgment of acceptance than is the case in the U.S., including the coded information found on the check itself.

The demanding nature of the Israeli information systems client requires corresponding software design ingenuity. Software houses that develop systems for local corporate customers and their users are able to export this advantage elsewhere. Exports to East European banking sectors are a case in point.

The Drivers: Cultural Circumstances

Broader cultural commentary surfaced during the interviews. Somewhat unexpected was the reference to the fact that Zionism, the movement that eventually led to the establishment of Israel, was among other things a cultural rebellion within the context of traditional Jewish existence. Thus, "modernity," "progress" and "advancement" were themes cherished in Israel, perhaps strongly linked to the founders’ legacy of utopian fantasies. This view fostered fascination with machines, engineering and automation.

This attitude had some negative effects as well. It was suggested that following the strong ideological roots of Israel’s "founding fathers" in the original socialist movements of the turn of the century, software was officially classified as "service" and thus disqualified for industrial support and subsidy reserved for "real" productive activities such as agriculture and manufacturing. As was the case in the Soviet Union and other socialist states where software suffered from similar problems, this hardware-centered or classical socialist view of work also partially explains the limited appreciation of marketing. Such attitudes have undergone a dramatic change in recent years, and failures in these domains are no longer matters of ignorance, but of poor execution.

In general, valuing deed over deliberation has sustained the rather impatient Israeli "culture of action," exemplified by the popular view that "you can only avoid mistakes if you are not doing anything," or the perception that democracy means "everyone can give it a try." The proverbial "Jewish mother"—the ultimate motivator—was mentioned (only half jokingly) as the origin of the Israeli-driven character which pushes Israelis to act, try and dare. This may explain in part the appearance of Israeli software in some unlikely places and circumstances (e.g., in the automated generation of Japanese crossword puzzles).

The revival of Hebrew as a daily spoken language has created technical challenges to foreign vendors of software, as well as forcing Israeli developers to consider linguistic implications and to become experts in the design of multilingual software. Language peculiarities limit the global marketing appeal of local products, but also create a software development environment which is somewhat protected from the global giants. Hebrew has partly isolated the Israeli IT profession from the rest of the world. Due to language boundaries there is no massive flow of people from the developed West who seek IT opportunities in the country.

There is some inflow of professional human know-how and experience through immigration, but by and large the Israeli IT human landscape, for better or for worse, is shaped by Israelis.

The return of foreign-educated Israelis may be another factor behind the successful embrace of computing. Israelis who could have lived and worked in the U.S. or Europe, but who decided to follow their cultural and emotional instincts and return home are common (some also apparently do not fit elsewhere because of their "disrespect for orderliness"). It is perhaps characteristic of strong nation-cultures, as similar sentiments are often expressed by expatriates who grew up in Greece or India. The returning Israelis have been bringing with them an experience base which is transplanted in the country, providing a short-cut in processes of local
Follow-ups and Pointers

We are most grateful to our interviewees [2], along with electronic correspondents Erran Carmel, Joseph Gill, Shimon Schocken and Katriel Zimet, for their willingness to share their time and insights with us, and to all the reviewers whose comments helped to improve this essay. Given the speculative nature of parts of our analysis, we should note that not all of these kind people necessarily share all the views expressed here (and such agreement is inconceivable given Israeli cultural traits).

An effort was made to look into computing in the Occupied Territories, but circumstances prevented us from collecting much information. The educational level of the Palestinians is one of the highest in the Arab world. Our limited initial impression is that there is a modest Palestinian computing community, with centers in several of the Arab colleges, especially on the West Bank. Some software development takes place, notably for locally used trilingual products (Arabic, English and Hebrew). Unfortunately, most of the Palestinian IT community is detached from both the Israeli mainstream and the rest of the Arab computing world, although email seems to be more available than is the case in many Arab countries. We welcome information from our readers and hope to present more on that perspective in the future.

MATIMOP, the Israeli Industry Center for Research and Development, maintains a Gopher on the Internet (at matimop.org.il) which contains descriptions of current science and technology activities in Israel, as well as general background information concerning the country and its economy.

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cultivation. The Israeli IT sector is a clear benefactor of technology transfer in human form.

On the other hand, brain-drain is also a problem as it is elsewhere, and it is possible that more Israeli IT professionals are leaving the country than returning. Nevertheless, it has not created a critical condition in the sense that it hampers the country’s ability to perform. It appears that few who leave permanently or for long periods cut themselves off. Most maintain contacts professionally (e.g., by generating export activities). Overall, for an isolated and often beleaguered country, Israel seems to have a good flow of people between itself and the larger international IT world.

An Israeli National Character of Software Development?

Can one tell an Israeli software development company from those of other countries? Does such a distinction make sense at all in a world increasingly based on standard technologies and offering homogeneous products and services such as airline reservation systems? While not unanimously supported, it was conjectured that distinctive Israeli features do exist. It was time and again stated as “brilliance without discipline” or given “commando” connotations. The latter theme surfaced vividly early on and remained largely valid for the entire series of interviews and facility visits.

The commando theme should not be interpreted in a “Rambo-simplistic” fashion. Clarifying the meaning of the term “commando” in the Israeli mind may be best done with a list of terms closely associated with it in the Israeli culture: imaginative, unconstrained, informal, quick, small scale, flexible, resourceful, front line, hard work, difficult, self-reliant, aggressive, lack of sense for order and administration, specialized, intensively trained, effective, action-oriented, trouble shooting, elitist, arrogant, improvisational, reactive. It should be noted that military commando units are highly regarded within Israeli culture, as evidenced by the tremendous interest of young recruits in joining them.

The notion of “IT commando” therefore imbues software and system development with those descriptors. It is an Israeli counterpart of the “hacker” theme and culture that has characterized parts of the U.S. software scene. While obviously short of being a formal thesis, this theme suggests some views on the strengths and difficulties of Israeli computing, and of software in particular.

Interestingly, a top manager who claimed that “we do not exploit our national character in our company,” turned quite naturally to describe how “informality” is the way responsibilities are handled in his company. Informality is commonly held to be a typical and distinctive Israeli management attribute. In this particular company the limits of possible informality actually determined the span of managerial control. Larger units which became too formal, were split and organized as independent businesses. Informality as an Israeli characteristic is often reinforced rather than suppressed by military service.

The commando themes, similar to the hacker themes in the U.S., should not imply a strictly positive heroic connotation. For instance, the impatient “action orientation” and flexible mentality have a clear effect on strategic IS planning in Israel. Typically, only companies that are influenced by the U.S. business community and standards are engaged in strategic IS planning. Furthermore, “commando properties” are very useful in product development and focused software problem solving but are less so
for long-term business strategy, marketing planning, patient attention to customer needs, or the immersion in different cultures to understand subtleties. It also fosters occasionally a provincial, parochial, small-country mentality that "I can do better." This element has been suggested as a limiting factor in the success of the Israeli software industry and in particular its export activities. Original predictions of performance figures were higher than those that have recently materialized, creating a feeling that "something is missing" and prompting the current focus on marketing [7].

As discussed earlier, most of our interviewees unequivocally perceived that the country’s IT human resource infrastructure was created at a critical time by military computing. The important role of military computing in the broader IT scene in Israel was unintended but fortuitous. Military computing itself was and is driven by defense concerns and needs, and it is not a component of a national IT public policy. Nevertheless, it is an example of an effective—although unintended—intervention in the shaping of the national IT landscape. Although it is centrally executed, it is vastly different from planned interventions elsewhere that attempt to shape the IT landscape in a top-down fashion (e.g., in Singapore or the former Soviet Union) [4].

Of course, the interaction among the roles of military computing in Israel with the other drivers is complex and the identification of isolated effects may prove to be difficult. Many of the things we found and attributed to the military are arguably more general Israeli attributes that are accentuated or amplified in these circumstances.

It is doubtful if the factors behind the strengths and weaknesses of computing in Israel would suggest general principles that may apply to a larger country or one that is completely open to its neighboring environment (e.g., the Netherlands). Are they even sustainable within Israel? Possibly not, considering the diluting trends of national identities (e.g., the "Americanization" of young Israelis), the prospects of a diminished siege mentality as well as a decrease in de-

References
2. Interviews with David Assia, Israel Borovits, Phillip Ein-Dor, Meir Dvir, Menachem Guterman, Shaul Lavi, Seev Neumann, Amiram Shore, Israel Spiegler, Giora Ullman and Yehuda Zisapel.
3. Israeli Association of Software Houses.