University of Haifa

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Project:
A Methodology for the Creation of Seed and Start-Up Capital Sources for High Tech Firms in Europe Following the Success Stories of the Yozma and Technological Incubators Programmes and its Application to the Italian Reality
Acronym: IFISE: Israeli Financing Instruments for the Support of Entrepreneurship

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Report:

Mapping the Israeli Start-Ups

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Content

Abstract

This study deals with the mapping of Israeli high tech start-up companies. It was conducted with the aim of furthering the understanding of various Israeli entrepreneurship encouragement programs, in particular Technological Incubators and Yozma. It is hoped that the conclusions of this study will serve as reference points to improve entrepreneurship encouragement policy in Europe.

In this study, full details of Israeli start-up companies, the characteristics of the entrepreneurs', and the companies' performances were documented. In addition, evaluations were made regarding the effects of environmental factors and of the difficulties that were encountered.

In general, it was found that entrepreneurs of start-ups were highly educated, mature adults, within an age range of 43-53 years. A large number held Ph.Ds, with a background in the high tech industry. A high tech working environment background was also shown to have served as the the origin of start-up company.

The study concluded that the major difficulties encountered for start-up development were: fund raising, marketing, international connections, recruitment of personnel, and protection of IPR. These factors were also the areas shown to be in need of government assistance. Of the government support measures, the R&D grants and the Technological incubators progrmmes were most widely used. As to funding sources, VCs were involved in more than half of the companies and in that respect the contribution of the government sponsored Yozma programme that spurred the genesis of VC in Israel should be noted.

In comparison to other sample companies and to the Technological Incubator companies, the protégé companies of Yozma were found to be more advanced in their business development stage but also of an older age.

Introduction

This study is a part of a project that deals with methodologies to encourage the creation of seed and start-capital for high tech firms. The Israeli experience presents two successful models: the Technological Incubators and Yozma that were described in our earlier report (1). It is proposed that these programs may be used as templates for programs that could be implemented in Italy or elsewhere in Europe. In this work we have undertaken to map the Israeli high tech start-up companies by defining and describing their main features as follows: The industrial branch distribution, founders' personal and professional data, sources of financing, some of the difficulties encountered in their undertakings, and employees. These details are important for planning, implementing or evaluating any entrepreneurship encouragement programs. In addition, to further our understanding of the Technological Incubators and Yozma programs, an attempt is made to unveil the specific and selective characteristics of the companies that were established by one of these programs. The findings and conclusions of this work will be integrated with other considerations upon the formulation of an entrepreneurship encouragement program for Italy.

Methodology

The methodology used for mapping the Israeli high tech start-ups was a Phone-Fax questionnaire (Appendix 1), devised together with the other participating research groups in this project. A pilot trial was conducted to test the questionnaire' s comprehensibility and its outreach to the relevant survey companies, who were arbitrarily chosen from a commercial database dedicated to the Israeli high tech Industry of D&A Hi-Tech Information Ltd. (2).

Our aim was to interview companies established after 1993. A preliminary test found that in comparison to other commercially available databases, this database holds the highest number of details of companies -- 1,200 in total. In addition, to ensure that the respondents were Israeli originated start-ups and in order to exclude Israeli branches of international organizations, only companies with headquarters located in Israel were included in our survey.

The Statistics Consulting Unit of University of Haifa conducted the telephone-fax interviews and data processing.

The survey was launched in April 2001 and conducted through June. During this period the recession in the high tech industry in the world and in Israel had already begun, and this had a direct bearing on the collaborating attitude of the companies contacted. Our aim was to interview 200 companies and to allow for non-cooperation, 800 companies were initially contacted. The final number of valid responses was 143 companies. A computerized system “Mega center” (3) was used to manage the survey' s operation and to ensure an objective selection of the respondents from the database. In each calling session the system allocated ten companies to each of the research staff to. The companies not wishing to participate were omitted and those unavailable at that time were reserved for another calling session. The interview cycles included a telephone call to determine the founders' identity, followed by the questionnaire being mailed to the founder personally. In most cases additional

follow-up calls had to be made to the founders before the completed questionnaires were returned.

The statistical analysis was conducted with an SAS system.

Most of the information presented in this report is based on details collected in the survey; details extracted from the database are marked where applicable.

Results

Section 1. Preliminary Tests - The Validity of the Sample

To verify that the sample of 143 companies is a valid representation of the database population of 1233, we conducted comparison tests of two different data points from the database and the sample. The first comparison test was that of the age of the company. The mean companies' age computed from the database were 3.2(±2.2) and the one computed from the sample was 3.5 (±2.2) years. The second test was the distribution of the number of employees in the companies (see Table 1).

Table 1: Distribution of Number of Employees in the Database and Sample Companies

Number of Employees	Database Companies		Sample Companies	
	Number	Total (%)	Number	Total (%)
1-5	74	6	9	6.6
6-9	174	14.1	20	14.7
10-19	351	28.5	46	33.8
20-49	378	30.7	33	24.6
50-99	165	13.4	18	13.2
100-249	70	5.7	7	5.2
>250	21	1.7	3	2.2
Total	1233	100	136	100
The mean employees' number	39.8		35.6	

Based on the comparative results shown above, it was concluded that the sample accurately represents the database.

Section 2. Industrial Branch Distribution, Age, and Employee Details

The following are some of the basic details characterizing Israeli high tech start-ups.

2.1 Industrial branch distribution

The data on the industrial branch distribution of the companies surveyed is summarized in Table 2 and illustrated in Figure 1. For classification we have used 19 industrial branch categories, but only 120 of the 143 companies (84%) are classified in the following eight main industrial branches:

- Communication (hardware) and electronic components
- Software for internet
- Software for other applications
- Electronic medical instruments and devices
- Software for telecommunication (ex internet)
- Biotechnology (excluding pharmaceuticals)
- Computer (hardware) semiconductor devices and electronic components
- Optical instruments and materials (including optical communication items)

Table 2. Industrial branch distribution

Industrial Branch	Companies	
	Number	Percent
Communication (hardware) and electronic components	29	20.3
Software for internet		17.5
Software for other applications	17	11.9
Electronic medical instruments and devices	15	10.5
Software for telecommunication (ex internet)	10	7.0
Biotechnology (excluding pharmaceuticals)	10	7.0
Computer (hardware) semiconductor devices and electronic components	7	4.9
Optical instruments and Materials (including optical communication items)	7	4.9
Industrial engineering and automation	5	3.5
New materials	4	2.8
Internet sites	4	2.8
Internet services	3	2.1
Precision instruments, measurements and control	3	2.1
Other	3	2.1
Pharmaceuticals	1	0.7
Total respondents	143	100

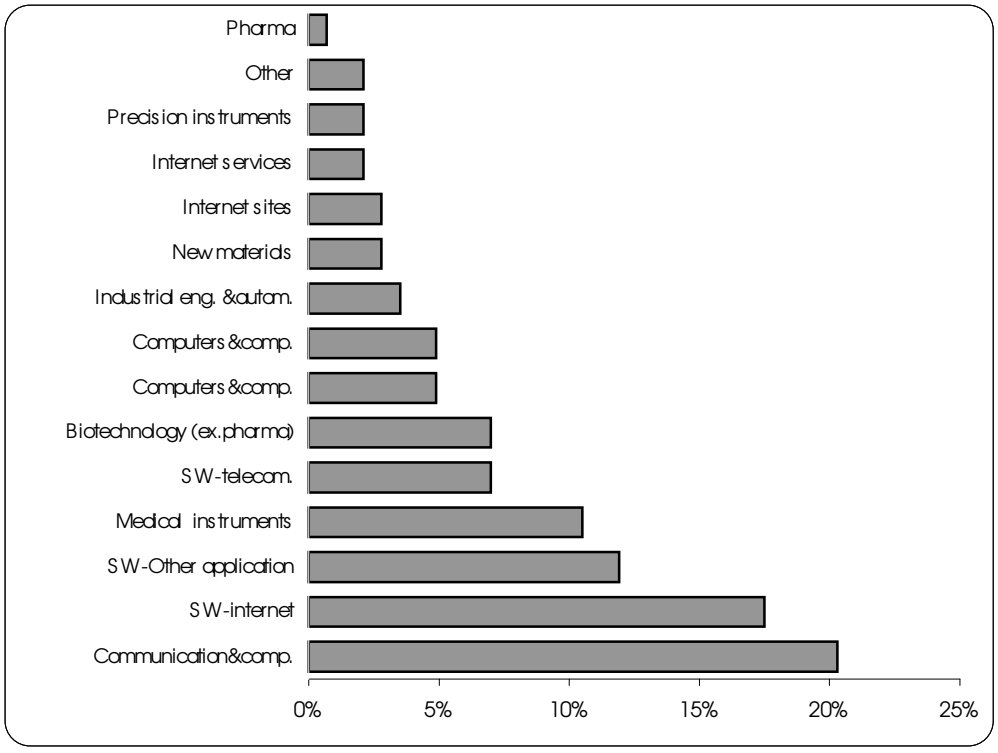

Figure 1. Industrial Branch Distribution of the Surveyed

High Tech Start-Up Companies

2.2 Age of companies

Analysis of the age of the responding companies (Table 3) was conducted from the information provided in the database. The data shows that 80% of the companies were under 5 years old and that the average age was 3.5 years.

Table 3: Age of the Companies

Age	Companies		Mean
	Number	Percent	
1 year	29	20.3	3.5
2-3 years	54	37.8	
4-5 years	31	21.7	
6+ years	29	20.3	
Total respondents	143	100	

2.3 Number of employees per company and their formal education

The classical EC definitions for firm size classification with respect to their employees' number include the following size groups: 10-19; 20-49; 50-99; 100-249 and over 250.

The Israeli business reality is somewhat different with many start-up firms having fewer than 10 employees. To adopt the EC classification to the Israeli reality we have added size classes for employees' number of 1-5 and 6-9.

The analysis of the firm size of the respondents showed that 80% of the firms have less than 50 employees and the average number is 36. Fifteen percent of the companies have fewer than 10 employees.

Table 4: Numbers of employees*

Number of employees	Company		Mean
	Number	Percent	
1-5	9	6.6	
6-9	20	14.7	
10-19	46	33.8	
20-49	33	24.6	
50-99	18	13.2	35.6
100-249	7	5.2	
250+	3	2.2	
Total respondents	136	100	

*The data was extracted from the database.

Examination of the formal education status of the respondents' employees revealed that the mean employees' number having formal academic degrees is 23.4. Based on above, we can conclude that, on the average, more than 65% of the employees of the Israeli start-ups have academic degrees.

Section 3. Business Development Status and R&D Expenditures

3.1 Business development status

The development cycle of technological start-ups with respect to their product development efforts is schematically assumed to proceed through the following phases:

R&D → Technological demonstration → â-site → Prototype → Initial sale → Sales

We presented this scheme to the respondents and asked them to indicate the most advanced stage of development attained by them.

Table 5 shows the result and indicates that 15% of the firms did not advance beyond the basic R&D activity and 25% are at various stages of more advanced development. Sixty percent of the respondents were involved in some initial or actual sales. A cross check with the details collected on the sales turn-over of the companies in the year 2000 corroborates this information with the findings that 56.5% of the firms had sales of $100K or over. The sales revenues for 2000 are shown in Section 5.5 of this report.

Table 5: Progress in Product Development

Most Advanced Development Phase of the Company To Date	Companies	
	Number	Percent
Research and Development	21	15.0
Technological Demonstration	6	4.3
Prototype	12	8.6
ß site	17	12.1
Initial sales	43	30.7
Sales	41	29.3
Total respondents	140	100

3. 2 R&D expenditures

In proportion to income, R&D expenditures were found, as expected, to be very impressive (Table 6). The average was 74% and more than half of the respondents (56%) spent 50% or more of their income on research and development.

Table 6: Proportion of R&D Expenditures to Income*

Proportion of R&D Expenditures to Income (2000)	Companies		Mean R&D Expenditure
	Number	Percent	
0-10%	9	11.1	
11-20%	11	13.6	
21-30%	5	6.2	
31-50%	9	11.1	
51-70%	12	14.8	74%
71-100%	31	38.3	
101+%	4	4.9	
Total respondents	81	100	

*Respondents were asked to provide approximate values.

Section 4. Information on the Founders

Background knowledge about the founders is important for the understanding of entrepreneurship in general.

4.1 Number of founders per company

The total number of founders of the surveyed companies was 368 with a mean number of founders per company of 2.6 (Table 7). Fifteen percent of the companies were founded by one entrepreneur, another 40% by two entrepreneurs, and groups of three or more entrepreneurs made up 30% of the companies.

Table 7: Number of Founders Per Company

Number of Founders	Companies		Overall Mean
	Number	Percent	
1	22	15.5	
2	57	40.1	
3	42	29.6	2.6
4	15	10.6	
5+	6	4.2	
Total respondents	142	100	

4.2 Academic status of the founders

Traditional formal degrees were used to assess the academic status of founders. In addition, graduation from military academic courses was included. These military courses provide high-level professional training to serving personnel and therefore graduates are found to contribute highly to entrepreneurship in Israel.

The results summarized in Table 8 indicate that 47% of the companies hade founders holding a Ph.D., 44% with a M.Sc., and 51% with B.Sc. Only 8% of the companies under study had founders without an academic degree and 6% had a Vocational Engineering degree. Although the abundance of Ph.D.s among entrepreneurs in Israel is well known, the contribution of the institutions of higher learning to entrepreneurship in high tech industry in Israel cannot be overstated.

Ten percent of graduates from military academic courses were found to be founders of companies. Whilst this figure is not insignificant, in Israel, where most of the population serves in the military, it should not be considered an outstanding finding.

Table 8: Academic Status of Founders

Academic Status	Companies*	
	Number	Percent
Non academic	11	7.7
Vocational Engineer	8	5.6
B.Sc. /B.A	73	51.1
M.Sc. /M.A	63	44.1
Ph.D.	67	46.9
Graduate from military academic courses	15	10.5

* Multiple responses per company were given. N=143.

The analysis of the professional disciplines distribution among the founders of the respondents is summarized in Table 9. Exact Sciences including Computer Science was found to be the most abundant discipline followed in descending order by Engineering, Life

Sciences, and Management and Economics. In 17% of the companies several of the founders had M.B.A training.

These findings accentuate the strong technological basis of the new enterprises and may point to a relative weakness in the management and business areas.

Table 9: Founders' Professional Training Disciplines

Founders' Professional Training Disciplines	Companies*	
	Number	Percent
Engineering	64	44.8
MBA	24	16.8
Exact / Computer Science	77	53.9
Management/Economic	21	14.7
Life Science	26	18.2

* Multiple responses per company were given. N=143.

4.3 Age and gender distribution frequency of the founders

Most of the entrepreneurs were found to be mature adults (Table 10) with the age range of 44-53 years being the most common. One hundred and four founders out of 314 (33%) fall into this category, 83 (26%) have ages ranging from 34-43, 74 (24%) range from 24-33 years, 53 (17%) are over 54 years and only six (2%) are over 66 years.

Table 10: Founders' Age Group Distribution

Present Age of Founders	Founders	
	Number	Percent
24-33	74	23.6
34- 43	83	26.4
44-53	104	33.1
54-65	47	15.0
66+	6	1.9
Total respondents	314	100

The presence of women among the founders is uncommon. Only 15 of the companies under study had women founders (Table 11), and within the founders' population some 19 are women compared with 330 men (5.45%).

Table 11: Prevalence of Women as Founders

Women per company	Number of Companies
1	13
2	1
4	1

4.4 Changes in leadership

A change of leadership in young companies often occurs following the transition from its infancy to adolescence. This transition is linked to changing priorities in the companies' immediate objectives and in the nature of its activities. The average age of the responding companies was determined to be 3.6 years and it may be correct to assume that many of the companies in our sample have reached this transition point.

Table 12 summarizes the present situation in the respondents' population. In 94 companies (67%) the founders' position is unchanged. However, in 46 companies (33%) some or all of the founders are no longer in a leadership position.

Table 12: Changes in the Founders' Position

State of Founders' Original Positions	Companies	
	Number	Percent
All are in the highest position	94	67.1
Some are in the highest position	30	21.4
None are in the highest position	16	11.4
Total respondents	140	100

Section 5. Entrepreneurship and Environmental Factors

Technological innovation depends on the creativity of the entrepreneurs as well as certain environmental factors.

The environmental factors in this study included geographical location and the working environment of the founders before their entry into a new enterprise.

5.1 Geographical location of new technologies

Globalization processes and extensive interactions on an international level characterize the high tech industry and usually facilitate an unrestricted flow of technological ideas between countries and markets.

Our respondents were questioned on the location of the original ideas for their new enterprises and given a choice of three: Israel, outside of Israel and an open choice. Results indicate that the majority of Israeli high tech start-ups (90%) were founded on ideas originally created in Israel. Just over 8% of the companies start-up origins were from outside of Israel, and in a few cases (less than 2%) the respondents specified a joint location origin (Table 13).

Table 13: Geographical Origin of New Technologies

Location of original idea	Companies	
	Number	Percent
Israel	128	90.1
Abroad	12	8.5
Both	2	1.4
Total respondents	142	100

5.2 The working environment

The majority of respondents (62%) indicated high tech industry as the birthplace of new ideas. The academic institutions served as incubating environments for 19.5%, with 15% of the companies indicating that the incubating environment came from low tech

industry. The list of working environments presented in the questionnaires is revealed in Table 14.

Table 14: Working Environment and Birthplace of the New Technology

Working Environment	Companies	
	Frequency	Percent
Academic institution	23	19.5
High tech industry	73	61.9
Academic + high tech	4	3.4
Low tech industry	18	15.3
Total respondents	118	100

As stated above (Section???) the study focused on the function of the defense-related industry, and established that 12% of the companies considered this as the birthplace of their new ideas.

To further investigate this point we studied the data on a longitudinal time scale and examined changes of this value over time. All the companies in our data base sample were established after 1993, and from these we formed three time groups: 1993-1995, 1996-1999 and 1999-2001. We then conducted a comparative examination of the incidence of military course graduates, which showed that the differences are statistically insignificant.

5.3 Prior occupation of founders

The occupation and role of the founders prior to the establishment of their new enterprises are described in Table 15. In 75.5% of companies the respondents indicated "industry" as their previous place of employment, with 17% stating academia or a research institute.

Table 15: Previous Occupation of Founders

Occupation	Companies	
	Number	Percent
Unemployed	2	6
Student	9	1.4
Academia, Research Industry	24	17
Industry	108	75.5
Total respondents	143	100

A breakdown of the positions held by founders previously employed in industry is shown in Table 16.

Table 16: Previous Industrial Positions of Founders

Position	Responses*	Number	Percent of Companies*
R&D	Manager	78	54.6
	Staff	31	21.7
Production	Manager	10	7.0
	Staff	1	0.7
Marketing /sales	Manager	33	23.1
	Staff	6	4.2
Total responses		159	

*Multiple responses per company were given.
**Number of companies was 143.

Almost all of the companies were founded by persons who had previously worked in R&D (76%). The second largest group was previously from marketing and sales (27%), while the smallest group had worked in production (8%).

Another important characteristic of the founders is that the majority of them (63.5%) were managers in their previous positions.

Section 6. Fund Raising Patterns and Success Indicators

Fund raising is the most challenging responsibility that entrepreneurs face. In Israel, as well as in many other countries, there are public programs offering entrepreneurs support in their endeavors in recognition for their contribution to economic growth. This chapter presents data on the fund-raising behavior of Israeli start-ups.

6.1 Government sources of financial and other support - Measures

The Israeli government encouragement programs were reviewed in our earlier report (1). A list of these programs and its utilization frequencies are detailed in Table 17.

Table 17: Frequency of Using Government Financial Sources

Government Financial Sources	Companies*	
	Number	Percent
Government Incubators	21	14.7
R&D grant – Regular	49	34.3
R&D grant - For start-up	5	3.5
R&D grant - "Magnet"	7	4.9
Bi-National programme – BIRDF	11	7.7
Bi-National programme – Other	1	0.7
Investment Center – Grant for capital equipment	11	7.7
Investment Center – Income tax benefits	21	14.7

*Multiple responses per company were given. N=143

The R&D grant program was most frequently used, with 49 out of 143 companies (34%) using this program. The second most popular programmes (15%) were the government incubator program and the Investment Center with its tax benefits program. However, it should be noted that, even when taking into account the more popular programs, the majority of the respondents uses no one program.

6.2 Non-government sources for financing for new start-ups

The findings for non-government sources for financing new start-ups are shown in Table 18 and Figure 3.

Table 18: Use of Non-government Sources for New Start-Ups

Non-government Financial Sources	Companies*	
	Number	Percent
Self	39	27.3
Family and friends	19	13.3
Private investors (Business Angels)	76	53.1
Private incubator	7	4.9
V.C	74	51.7
Bank loan	17	11.9
Stock exchange; IPO	8	5.6
Investment company	14	9.8
Strategic investor in Israel	14	9.8
Strategic investor abroad	13	9.0
Other source	10	7.0

*Multiple responses per company were given. N=143

As anticipated, the companies used many sources of funds simultaneously. The frequency analysis of using different financial sources shows some patterns: Private investors and V.C funds were most prominent. Fifty-three and 52% of the companies used these sources. Private money provided by the founders themselves ("self"=27%), together with funds provided by family and friends, accounted for financing 40% of the companies.

The findings emphasize the relative importance of private funds in facilitating entrepreneurship in Israel. It would be interesting to reveal the contribution of the tax benefits schemes for investments in approved projects for the situation described above.

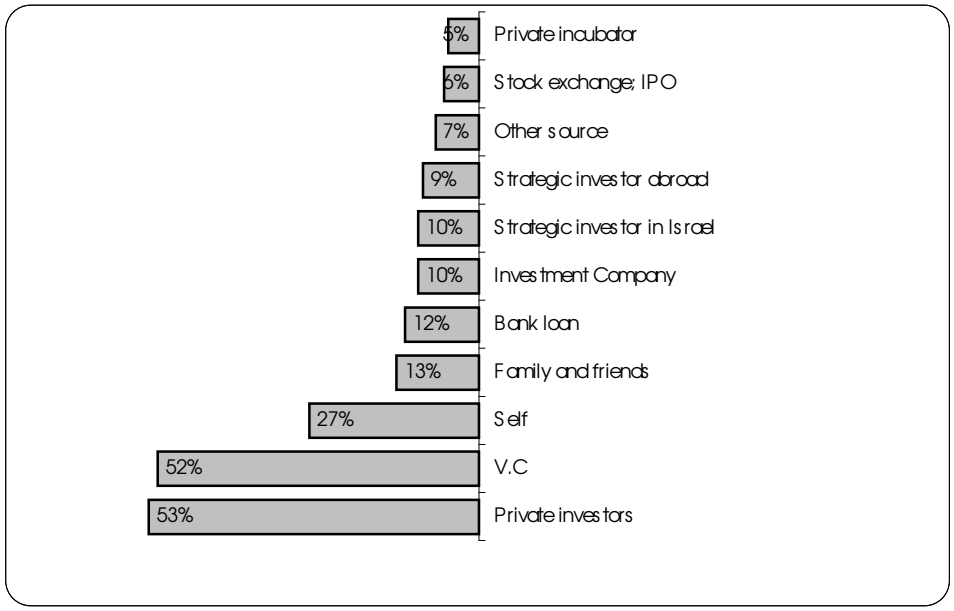

Figure 2: Non-government Financial Sources

As can be seen from Table 19, other sources for funding were also recorded.

Table 19: Frequency of Using Other Funding Sources

Sources of Funding	Companies*	
	Number	Percentage
Israeli stock exchange	0	0
Foreign stock exchange; NASDAQ	7	4.9
M&A with Israeli entity	3	2.1
M&A with foreign entity	5	3.5
Other foreign stock exchange	1	0.7

*Multiple responses per company were given. N=143

The sources listed in Table 19 were used in a sporadic manner. Only 7 out of 143 companies used NASDAQ and 8 exercised M&A with foreign or domestic entity.

6.4 Fund raising patterns

As stated above fund raising is a major effort and energy consuming undertaking. The numbers of fundraising rounds that were made by the Israeli start-ups were recorded and the

findings (Table 20) indicate that 39% of the companies used only one round of fund raising, 24% - two rounds, and 20% - three rounds.

Table 20: Number of Rounds Used for Fund Raising

Number of Fund Raising Rounds	Companies	
	Number	Percent
1	48	39
2	29	24
3	24	20
4	15	12
5	6	5
Number of respondents	122	100

The distribution of the sums raised in each of the rounds is presented in Table 21 and Figure 3. As seen in the figure, it is possible to detect some specific patterns in each round:

In the first round the amounts were spread almost evenly between the sums' categories of <150K, 151-600 and 2-3M. In the second round most companies raised sums in the category of 2-3M, followed by the >3M category. In the third round most of the companies (46%) raised sums in the >3M sum category followed by the category of 2-3M.

Table 21: Sums Raised in the Different Rounds

	Companies (% of total)		
Sums Raised ($)	Seed Capital	Round 1	Round 2
<50K	12	3.5	3.8
<150K	14	5	1.9
<300K	19	11	3.8
<600K	18	3.5	3.8
<1M	7	14	7.7
1-2M	12	26	19
2-3M	11	8	13.5
3-5M	2	14	15.4
5+M	6	15	30.8
	100	100	100

Figure 3: Fund Raising Rounds - Distribution of Sums in

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6.5 The prevalence of Yozma Venture Capital Funds as a source of funding

Yozma was a government-sponsored program that aided some 11 venture capital funds. We therefore were interested to determine the prevalence of Yozma VC funds as a source for funding among the respondents.

Table 22: The Prevalence of Yozma VC Funds as the Initial Funding Source

Yozma VC Funds	Companies*	
	Number	Percent
Eurofund	4	14.8
Medica	1	3.7
Walden	4	14.8
Gemini	3	11.1
Nitzanim	1	3.7
Apex	3	11.1
Inventech	4	14.8
Polaris	9	33.3
Vertex	2	7.4
Jerusalem Pacific Ventures	0	0
Star	4	14.8

*Multiple responses per company were given. N=27

The results in Table 22 show that 27 companies (19%) were supported by one or more of the Yozma VC funds. Polaris was the most frequently used. In general, the prevalence of the Yozma VC funds as a source of funding was moderate.

Section 7. Incubator-graduate and Yozma-affiliated Companies in Comparison to Other Sample Companies

The Technological Incubators and Yozma programs are two of the most well known entrepreneurship encouragement programs that have been implemented in Israel. A detailed description of all these programs was presented in our earlier report (http://ifise.unipv.it/reserved.html).

Parallel to our undertaking of mapping Israeli start-ups in the high tech industry, we were also interested in exploring any specific contributions that these programs have made on the characteristics of Israeli start-up companies.

In this report we have referred to a start-up company as one that has obtained funding from one of the Yozma initiated venture capital funds, such as the "Yozma-affiliated company". In addition, a start-up company that commenced its activity within a government sponsored technological incubator was addressed as "incubator-graduate company". In this section, companies in each of these sub groups were compared to other start-up companies in the sample referred to as "sample companies". It is hoped that this analysis may shed additional light on the impact of these programs on the creation of start-up companies in Israel.

The parameters used for the comparison were as follows:

- Companies mean age
- Number of employees
- Raising funds through IPO
- Sales values in year 2000
- Growth rate (increase in turn-over) in the years 1998, 1999 and 2000
- Former employment of the founders

- The employment environment where the new idea originated.
- The prevalence of an M.BA degree among the founders.

The comparison results of these parameters are shown in Tables 23 through 30.

7.1 Comparison of Incubator-graduate companies to Sample companies

The comparison between incubator-graduate companies and sample companies revealed some interesting findings, which we have detailed below.

The Incubator companies are of the same mean age as the Sample companies but have significantly smaller number of employees: 12 compared with 40. These results are statistically significant as indicated in Table 23. None of the 22 Incubator-graduate companies have raised funds through IPO and their sales revenues in year 2000 were significantly lower than that of the sample companies.

Table 23: Comparison of Incubator-graduate Companies and Sample Companies*

Parameter	**Finding**	**Statistical Test**
Companies age	No difference was found	Wilcoxon; P=0.2251
Employee number (mean)	The mean employee number is **significantly** different: Incubator-graduate companies -- 11.9 employees Sample companies -- 39.9 employees.	T test; T(133)=4.6 P<0.0001
Raising funds through IPO	7 out of the samples' 143 companies raised funds through IPO. None were Incubator-graduates.	

*22 Incubator-graduates were compared to the Sample companies 123 companies

Table 24 summarizes the results of the comparison made on sales revenues. It is evident from the data that the Incubator-graduates were found more often in the "No sales" group and none had sales revenues of 1M or more. The $\div^2$ test results are: $\div^2$ (2) = 6.9204, P<0.0314).

Table 24: Sales Revenues (2000) of Incubator-graduate Companies and Sample Companies*

		Respondents (% of total)	
Incubator-graduate companies		**Yes**	**No**
Sales, $	**No sales**	63	52
	100k-1M	37	22
	>1M	0	26

*19 Incubator-graduate companies were compared to 110 Sample companies.

A further comparison of the two groups of companies dealt with the growth rates during the years 1998 through 2000. As can be seen in Table 25 no specific differential patterns are evident from this comparison, nor were any revealed by a statistical analysis. However, a general trend of change occurring in the growth rates of all the companies may be detected. With the progress of time there are fewer companies in the "No growth" group and more companies in the two positive growth rates groups: in the "1-40%" and in the ">40%" group. Thus, there is a universal positive process of development for all the companies albeit with a possible slower pace for the Incubator-graduate companies. The data is summarized in Table 26.

Table 25: Growth Rate of Incubator-Graduate Companies and Sample Companies

Incubator-graduate Companies		**1998**		**1999**		**2000**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
No. of respondents		9	52	12	58	13	67
Companies (% of total)							
Growth %	**No**	**78**	**57.5**	**58**	**48**	**31**	**39**
	1- 40	**11**	**13.5**	**42**	**23**	**38**	**33**
	>41	**11**	**29**	**0**	**29**	**31**	**28**

Table 26: Growth of Incubator-graduate Companies and Sample companies

Incubator-graduate Companies			
	1998	**1999**	**2000**
No growth	78	58	31
Growth	22	42	69
Sample Companies			
	1998	**1999**	**2000**
No growth	57.5	48	39
Growth	42.5	52	61

7.2 Comparison of Yozma-affiliate companies and Sample companies

The Yozma-affiliated companies were found to be "older" than the Sample companies. The mean age of the Yozma-affiliate companies was 4.5 compared with 3.3 (P=0.0340) for the Sample companies. In addition, it was found that the Yozma-affiliate companies had a significantly higher number of employees -- 88, compared with 22 for the Sample companies (P<0.0014) (Table 27), and of the 7 companies reporting the use of IPO for fund raising, 5 were Yozma-affiliates.

Table 27. Comparison Mean Age of Yozma-affiliated Companies and Sample Companies*

Parameter	Finding	Statistical test
Companies age (mean)	Yozma-affiliate companies were found to be **significantly** "older" than the Sample companies: Yozma-affiliate companies -- 4.5 years Sample companies -- 3.3 years.	Wilcoxon; P=0.0240
Employees number (mean)	The mean employees' number is **significantly different:** Yozma-affiliate companies -- 88 employees Sample companies -- 22 employees.	T test; T(27.8)= -3.56 P<0.0014
Raising funds through IPO	7 out of the samples' 143 companies raised funds through IPO. 5 were Yozma-affiliates.	

*28 Yozma-affiliated companies were compared to the 115 Sample companies

In view of the above findings, it was not at all surprising that the sales revenues for the Yozma-affiliate companies in 2000 were also significantly higher ($\div^2$ (2) = 6.67826 and P<0.0337) (Table 28).

Table 28: Sales Revenues (2000) of Yozma-affiliated Companies and Sample Companies*

		Responding companies (% of total)	
Yozma-affiliate Companies		**Yes**	**No**
Sales, $	**No sales**	46	55
	100K-1M	12.5	27
	>1M	41.5	18

*24 Yozma-affiliate companies were compared to 105 Sample companies.

Comparison of growth rates of the Yozma-affiliate companies to the Sample companies is summarized in Table 29. The data shows patterns of improved performance of growth of Yozma-affiliate companies over the Sample companies. The proportion of Yozma-affiliate companies in the group of the companies indicating "no growth" during 1998-2000 is smaller than that of the Sample companies. When comparing both companies' growth rate of over 41%, the Yozma-affiliated companies shows a consistently higher growth rate than the Sample companies by 1.6 to 2 fold. These differences, however, were not confirmed by statistical analysis.

Table 29. Growth Rate of Yozma-affiliate Companies and Sample Companies

Yozma-affiliate Companies		**1998**		**1999**		**2000**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
No. of respondents		13	48	15	55	17	63
Companies (% of total)							
Growth %	**No**	46	64	47	51	24	41
	1-40	8	15	13	29	35	33
	>41	46	21	40	20	41	26

7.3 Discussion and further analyses

In comparison to the Sample companies, the Incubator-graduate companies in comparison with the Sample companies show a slower growth development pace. Although they do not differ in their age, in the year 2000, they had a smaller number of employees and lower sales revenues. In addition, the Incubator-graduate companies are less inclined to use IPO as a fund raising tool, which could be yet another indication of taking more time to reach business maturity.

With regard to the Yozma-affiliate companies, they are found to be older than the Sample companies. In the year 2000 the Yozma-affiliates companies had more employees, higher sales revenues and apparently a faster growth rate than the Sample companies. Most of them used IPO for fund raising. The comparison of these two companies is not clear, and for a full understanding additional studies will need to be carried out. We did, however, conduct additional tests with a reflection that the explanations may be linked to the basic different features of the companies.

To begin with we looked at the industrial sector affiliation profiles of the two groups. The industrial sector affiliation of all the responding companies is shown in Table 2. Due to the relative small numbers of companies in the sub-groups (28 for Yozma and 22 for the Incubators companies), plus the widespread sector distribution, it was difficult to draw definite conclusions from these comparisons. Some factors, however, are worth noting: The two largest sectors for the Incubator companies are Biotechnology (23%) and Optical instruments (18%). The two largest sectors for the Yozma-affiliate companies are Communication hardware (28%) and Telecommunication software (11%). The fact that during the last several years, business in telecommunication has been vibrant could have had an influence on the better performance of the Yozma-affiliate companies. It should be noted that there are no Biotechnology companies among the Yozma-affiliate companies.

Attempts were also made to perceive if the differences in the companies' performances are linked to the training of the founders in M.BA. The comparison indicated no statistically significant differences between the sub-groups in that regard and in both groups the numbers are very small, e.g., Sample companies 21:98, Yozma-affiliate companies 3:28, and Incubator-graduate companies 1:22.

Differences that may have influenced the business development pace were found when we compared the backgrounds of founders and the working environments in which the new idea originated.

We have previously described in Section 4 that the majority of founders came from a high tech industry, a factor pertinent to all three groups of companies. The proportions, however, prove to be interesting. For example, in the Sample companies, the proportion was 77%, in the Yozma-affiliate companies it was 71% and in the Incubator-graduate companies it was 41%. This latter group has a larger proportion of founders coming from academic research - a proportion of 36% compared with 18% for the Yozma group and 12% for the Sample companies group. When we compared the working environment that lead to the origin of the new idea (Table 30) we found similar results. For Yozma-affiliate companies this environment was mostly another high tech industry (80%) and for the Incubator-graduate companies it was mostly academic institutions (50%).

Table 29: Previous Occupation of the Founders of the Different Companies Groups

	Previous occupation (% of total)			Total Number of Companies
	Industry	Academic and Research Institution	Other Occupations	
Incubator-graduates	41	36	23	22
Yozma affiliates	71	18	11	28
Sample companies	78	12	10	98

In conclusion, we can affirm that Yozma-affiliated companies have a more advanced business maturity, which may possibly be linked to their "older" age. Another important factor in the improved performances of these companies could be attributed to the more prominent high tech industry background its founders. With regard to policy planning and encouragement programs for new entrepreneurs the findings presented above market a target population that is worth of attention.

Table 30: Working Environment Leading to the Origin of New Idea

	Companies (% of total)			
Environment	High Tech Industry	Traditional Industries	Academic Institutions	High Tech & Academic Institutions
Incubator-graduates	28	11	50	11
Yozma affiliates	80	4	12	4
Sample companies	63.5	20	15	1.5

Section 8. Ranking the Expectations of Government Assistance and Difficulties Encountered

In the context of this research, the difficulties encountered by the entrepreneurs and their expectations for government assistance are central reference points to the development of new encouragement programs.

To document the respondents' views we presented them with a list of areas of activities assumed to be difficult for start-ups, and asked them to rank the levels of difficulty on a 1-5 scale for each. In addition the respondents were asked to indicate whether they think that these areas should be government-assisted. The results are summarized in Table 31.

Table 31: Levels of Expectations of Government Assistance and the Difficulties Encountered

	Area of Difficulty	Difficulty index (mean) *	"Yes" to government assistance (% of the companies)**
1.	Fund raising	4.2	58
2.	Marketing	3.8	45
3.	Connection to funding sources	2.9	44
4.	Locating and arranging for building facility	1.8	19
5.	Recruiting	3.2	19
6.	Networking with other firms on professional matters	2.5	17
7.	Networking with professional expert individuals	2.4	7
8.	Networking with strategic partners	3.5	37
9.	Networking with suppliers	1.9	7
10.	Advice on management matters	2.2	17
11.	Connection with international collaborators	3.3	49
12.	Sources for technical information	2.0	22
13.	Training of existing personnel	1.8	26
14.	Protection of IPR	2.8	32
15.	Advice on strategic matters	2.5	16
16.	Advice on legal matters	2.1	13
17.	Information on the trends in the markets and on technology developments	2.4	24
18.	Other	3.0	1

* The respondents were asked to rank each difficulty on a scale of 1-5; ** Companies (%, N=143) of respondents indicating, "Yes" to the question on the need for government assistance.

Areas of activities receiving a difficulty index of 2.4 or higher may be considered most problematic (Figure 4). Generally, 30% or more of the companies as being the areas most in need of government assistance also indicated these areas. The ranking of six of the most difficult activity areas were compared to the ranking they received with regard to the need for government assistance (Tables 32 and 33).

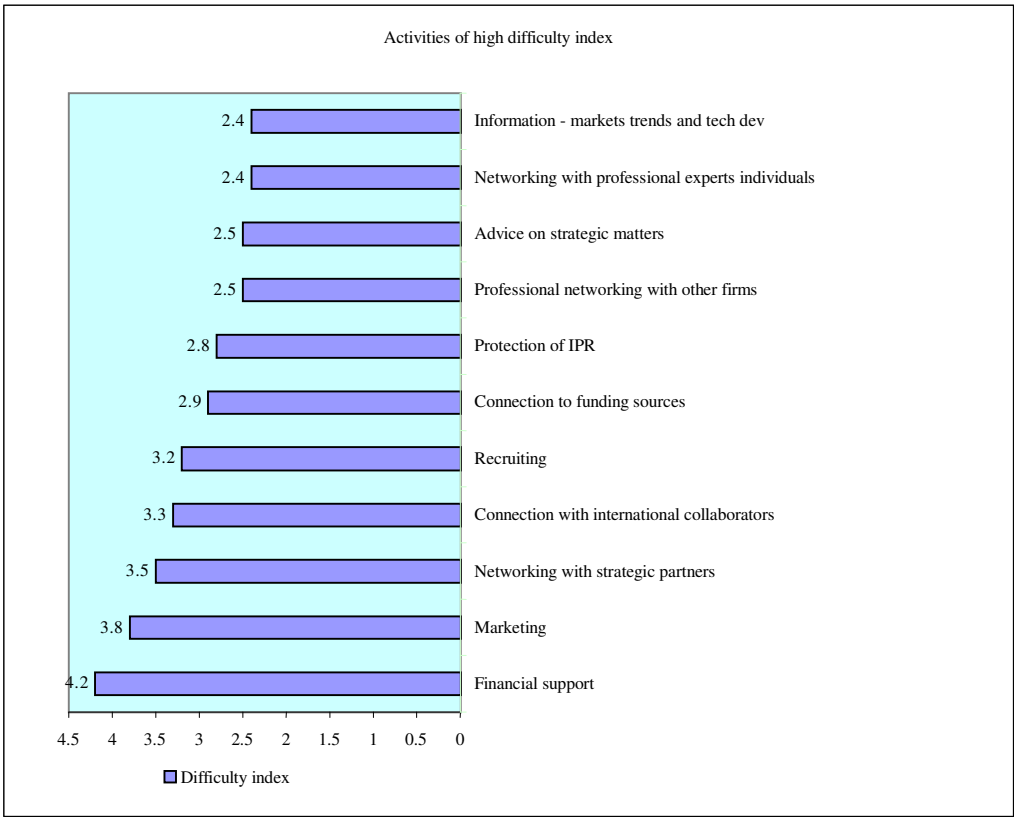

Figure 4: The Areas of Higher Difficulty

Table 32: Seven Most Difficult Activity Areas

Areas of activity	Difficulty index (mean) *
Financial support	4.2
Marketing	3.8
Networking with strategic partners	3.5
Identifying and facilitating international collaborators	3.3
Recruiting	3.2
Connection to funding sources	2.9
Protection of IPR	2.8

* The respondents were asked to rank each difficulty on a scale of 1-5.

Table 33: Six Areas in which Government Assistance is Most Expected

Areas of activity	"YES "to government Assistance (% of the companies)*
Financial support	58
Identifying and facilitating international collaborators	49
Marketing	45
Identification and facilitating linkage to financial sources	44
Networking with strategic partners	37
Protection of IPR	32

*Companies (%, N=143) that respondent with "Yes" to question on the need for government assistance.

In general there is excellent accord between the ranking of the index of difficulty and the expectations for government assistance, thereby explaining that the areas of higher difficulty are also the areas where government assistance is most expected. The minor discrepancies between the positions of the activity areas on the difficulty scale and their positions on expectations for government assistance scale may be related to the limited sensitivity of the analysis.

We may conclude, therefore, that the general areas of high difficulty are as follows:

- Fund raising and access to funding sources
- Marketing
- Networking or connection to strategic partners and international collaborators
- Protection of IPR

- Recruiting of personnel

The last category is somewhat unique as having a high difficulty score of 2.8/5.0 but a low score for the need of government assistance (19%). We can only speculate that the entrepreneurs' doubts of the efficiency of government involvement are the reason for this irregular response.

Summary and Conclusions

The typical characteristics of the Israeli start-up companies may be summarized as follows:

Company characteristics

The areas of technology in which the start-up companies are involved reflect up-dated world trends. There is an almost even mix between hardware and software related fields and Biotechnology is very prominent.

On average, the companies are 3.5 years old and employ 36 employees, 65% of whom have academic degrees. Forty percent of the companies have not launched any sales activities and they are currently engaged in various stages of R&D for which they spend (mean value) 74% of their income.

The founders

The founders of the start-up companies are typically mature adults with an age range of 44-53 years. With regard to gender characteristics only five percent of the founders are women. Most of the companies were established by 2 (40%) or 3 entrepreneurs (30%), who are graduates with higher academic degrees. To illustrate, in 51% of the companies the founders hold an M. Sc., and in 47% of the companies they hold a Ph.D. Most of the founders (75%) came from an industrial background prior to the establishment of their new enterprises. Sixty-two percent of the founders indicated specifically that the high tech industry was the breeding ground for their new entrepreneurship ideas. Prior to their involvement in the new enterprise, most of the founders were connected to R&D work where they held managerial positions.

The role of the universities and academic institutions

While academic institutions were found to have a prominent role in the actual training of personnel, this study established a minor role of the institutions with specific regard to the entrepreneurship process itself. Indeed, very few companies (19.5%) stated that the academic institutions served as an actual induction source for the new start-ups companies.

The role of military technical experience and defense related industries

The present study illustrated the insignificant role of the military and defense related industries. In our findings only 10% of the founders and 12% of the companies indicated any previous connections with the military and defense related sectors.

Fund raising models

Business angels (53% of the companies), venture capital funds (52%) and the entrepreneurs own money or of their close friends and families (40%) are the dominant direct sources for the funding of Israeli start-up companies. Although this study did not conduct a direct comparison, its findings have led to the conclusion that Government programs are secondary in importance with regard to direct funding sources. The most popular government support program is the one offering grants for sharing R&D costs, which, in comparison to the above, was used by 34% of the respondents. Thus said, however, our conclusions do not suggest that government programs play a minor role in the foundation of entrepreneurship in Israel. Indeed, it is sufficient to bear in mind that the Israeli venture capital industry is a direct product of the government program Yozma.

The majority of start-up companies raised their funds in one to three rounds: The first round -- 39% of the companies, second and third stages were 24% and 20% respectively. It should be noted, that the stock exchange was not an important source of funds for the companies participating in this study. In fact, only 5.6% of the companies under study raised

funds from the stock exchange; this low figure is perhaps due to the development stage of the companies.

Distinctions within the Technology Incubator and the Yozma programs protégé companies

In comparison with the Sample companies, Incubator-graduate companies demonstrate a much slower development pace. Even though both groups of companies do not differ in age, and the differences in industrial sectors affiliation is not dramatic, Incubator-graduate companies did have a smaller number of employees and lower sales revenues for the year 2000. The incubator-graduate companies are also less inclined to use IPO as a fund raising tool, and this may, in fact, be yet another reason for taking longer to attain business maturity.

In comparison to the Sample companies, Yozma-affiliate companies are generally more established, have a larger number of employees, higher sales revenues and noticeable faster growth rates for the year 2000. Most of the companies (5/7) reported to having used IPO for fund raising.

Besides the differences in the mean age of the companies, the improved Yozma-affiliate companies' performances could be due to their entrepreneurs having closer industrial background and industrial links.

Difficulties encountered by entrepreneurs and their expectations of government assistance

Our study showed that the five most complex difficulties the entrepreneurs encountered were as follows:

- Fund raising and access to funding sources
- Marketing
- Networking or connection to strategic partners and international collaborators
- Protection of IPR

- Recruiting of personnel

With the exception of recruitment of personnel, the companies' expectations of government assistance were high. Even though recruitment of personnel was included in the list of difficulties, it was not selected by the start-ups as an area in need for government assistance.

It is believed that the information generated from this study includes many key reference points for future planning, and is very important for the design of new entrepreneurship encouragement programs.

References

1. **Sadovski A. 2001.** The Innovation System, the Technological Incubators, and Yozma Programmes as Tools for Encouragement of High Tech Industry in Israel.

   Project report: http://ifise.unipv.it/reserved.html

2. **D&A High Tech Information Ltd.** Bezalel St. 19,P.O.B 3665, Ramat-Gan 52136

   info@dainfo.com

3. **Mega Center…**

Appendices

University of Haifa

Center for Study of Organizations & Human Resource Management

Questionnaire

Mapping the Israeli Hi-Tech Start-Ups

This study is supported by the EU-5th Framework Programme-Innovation

The project name: Israeli Financing Innovation Schemes for Europe (IFISE)

Confidentiality Statement: The researchers and the surveying personnel are obliged to full confidentiality of the identity and details of the interviewees.

A summary of the research results will be provided to the firms that participated in the survey.

This English version of the questionnaire will be translated to Hebrew for actual implementation.

The questionnaire sections:

A. General details of the firm and sector classification

B. Details of the founders and their background

C. Financial sources

D. Difficulty indices for activities related to the establishment of a new company

E. Success indicators of the company

Questionnaire

A. ***General details of the company and industrial branch classification***

1. Name of the company: _____

2. Number of employees holding an academic degree: _____

3. Industrial branch:

1.	Pharmaceuticals	9.	Aerospace
2.	Electronic Medical Instruments and Devices	10.	Biotechnology (Excluding Pharmaceuticals)
3.	Fine Chemicals	11.	Energy
4.	New Materials	12.	Ecology
5.	Industrial Engineering	13.	Telecommunication Software (Ex Internet
6.	Industrial Automation	14.	Internet Services
7.	Computer (Hardware) Semiconductor Devices and Electronic Components	15.	Internet Sites
8.	Communication (Hardware) and Electronic Components	16.	Software For Internet
9.	Precision Instruments, Measurements and Control Apparatus	17.	Software for Other Applications
10.	Optical Instruments and Materials (Including Optical Communication) Items)	18.	Other Sector - Specify_____

4. **What is the business development phase of your company today:** (Mark the most advanced stage reached by the company)

Initial sales ____	R&D____
Sales ____	Technological Demonstration ___
Other ____	ß site ____
	Prototype ____

B. ***Details of the founders (entrepreneurs) and their background*****:**

_____

_____

_____

5. **How many persons founded the company: _____**

6. **What was the formal schooling degree of the founders:** (Please indicate the number of people per category.)

Non academic____	M.Sc./M.A ____
Vocational Engineers____	Ph.D.____
B.Sc./B.A ____	Other ____
Graduate from special military academic courses ____	

7. **What are the professional training disciplines of the founders**: (Please indicate the number of people per category.)

Engineering ____	Management/Economic ____
Life Science ____	MBA ____
Exact / Computer Science ____	Other ____

8. **What is the current age of the founders?**

Founder 1_____Founder 2_____Founder 3_____Founder 4_____

9a. **How many women were among the founders? _____**

9b. **How many men were among the founders? _____**

10. **Are *all* the original founders still heading the company?**

Yes____ No___

If your answer is "NO", how many of the founders are not holding their original position:

All the founders_____ some of the founders_____

11a. **Please indicate the *location* where the original idea for the new product or technology was created:**

In Israel ____ Abroad ____

11b. **What was the *working environment* in which the original idea for the new technology was created ?**

Academic institution ____

High Tech industry ____

Low Tech industry ____

Other ____

If "Industry", was it defense related Industry?

Yes____ No____

What was the approximate number of employees in your previous industrial organization _____

12. **What were the occupational circumstances or positions of the founders prior to the establishment of the new enterprise:** (Please mark the relevant lines and indicate the number persons in each category):

Students ____ Unemployed ____ Academia ____ Research institute ____ Other ____

If employed by an industrial organization, please mark:

R&D: staff ____ manager ____ Marketing /sales ; staff ____ manager ____

Production: staff ____ manager ____ Other_____

C. ***Financial sources***

13. **How many fund-raising rounds were performed so far and what were the sums raised in each round (In $K)?**

Sum, $K (Check the highest)	**Seed capital**	**Round 1**	**Round 2**	**Round 3**	**Round 4**
< 50					
< 150					
< 300					
< 600					
<1000					
2000-3000					
3000-5000					
>5000					

14. **Which non-government financial sources did your company use?** (Grade the relative sizes of the appropriate sources as follows: the largest is marked as "1" and the others are marked sequentially).

Source	**Mark if "Yes"**	**Grade by relative size**	**Is the source from abroad**
Self			
Family and friends			
Private investors (Business Angels			
Private incubator			
V.C.			
Bank loan			
Stock exchange; IPO			
Investment Company			
Strategic investor in Israel			
Strategic investor abroad			

15. **For companies that received investments from a VC only:** (Please indicate if you were supported *by any* (one or more) of the following Yozma VC funds:

Eurofund		Inventch	
Medica		Polaris	
Walden		Vertex	
Gemini		Jerusalem Pacific	
Nitzanim		Star	
Apex			

16. **Which government financial sources did your company use?** (Grade by relative size of amount received: "1" indicates the largest and others are marked sequentially).

Funding Source	**If "Yes", please mark with √**	**Grade by relative size**
Government incubators		
R&D grant - Regular		
R&D grant - For start-up		
R&D grant - "Magnet"		
Bi-National programme – BIRDF		
Bi-National programme – Other		
Investment Center – Grant for capital equipment		
Investment Center – Income tax benefits		

17. **Did your company use the following sources of funding:**

Funding Source	**If "Yes", please mark with √**
Israeli stock exchange	
M&A with foreign entity	
M&A with Israeli entity	
Foreign stock exchange	
Other foreign stock exchange	
NASDAQ	
If, other, please state _____	

D. ***Difficulty indices and expectations for government support for the founding of new enterprises***

19. **Consider the following areas of activities that are central to the founding of new companies and assign a "difficulty index" to each.** (The difficulty index is a relative number on a scale of 1-5 where "5" is "most difficult" and "1" is "not difficult". Also, please indicate in what areas of activity do you expect government assistance?)

Area of activity	**Difficulty index (1-5)**	**Government need to assist? Yes/No**
Fund raising		
Marketing		
Connection to funding sources		
Locating and arranging for building facility		
Accessibility to labor pool and recruitment		
Networking with other firms on professional matters		
Networking with professional expert individuals		
Networking with strategic partners		
Networking with suppliers		
Advice on management matters		
Connection with international collaborators		
Sources for technical information		
Training of existing personnel		
Protection of IPR		
Advice on strategic matters		
Advice on legal matters		
Information on the trends in the markets and on technology developments		
Other		

E. ***Success indicators for the company***

19. **For statistical purposes only! Please indicate your annual turnover for 2000 (in K$)**.

No sales ____ <100____ 100-500 ____ 500-1,000 ____

1,000-3,000 ___ 3,000-10,000 ____ 10,000- 50,000 ____ >50,000 ____

20. **Please indicate the growth rate of the company (increase in sales revenues) during each of the last four years**

%	1998	1999	2000	2001-Expectation
No growth				
< 10				
11-20				
21-30				
31-40				
41-60				
>60				

21. **What was the approximate rate of R&D expenditure in relation to the sales revenues (in %) for the year 2000? ____**

***** *** *****

Are you interested in a summary of the survey's results? Yes____No____