EDUCATION & BUSINESS

ISRAEL

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Ministry of Education
Science and Technology
Administration

מדינת ישראל
משרד החינוך

EDUCATION AND BUSINESS STUDY

Israel

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INTRODUCTION

Many countries around the world are reinforcing the capacity of their education and training systems to respond to the pressures of globalisation and the challenges of the knowledge society. Closer cooperation between business and education is one of the tools for providing learners with new skills and competencies for work. However, the knowledge that is available regarding the current forms and modes of cooperation between the education and economic sectors, and the roles and responsibilities of the different stakeholders, is limited and fragmented.

Directorate General for Education and Culture has commissioned the ETF to carry out a study on education and business cooperation in the neighbouring countries and territories of the EU with the aim of:

- drawing up an inventory of existing cooperation between education and business;
- identifying the extent to which EU approaches and policies are relevant to those of its neighbours;
- providing tailored information and recommendations to national policymakers and donors for future programming initiatives and capacity-building measures.

For the purpose of this study, the term ‘education’ includes vocational education and training (VET), and post-secondary non-tertiary and tertiary education, including public and private institutions. The term ‘business’ covers any entity that undertakes economic activity, regardless of its legal status. This can include multinationals, public and private large companies and small and medium-sized enterprises (SMEs), micro-businesses and actors in the informal economy, social partners (employers’ and employees’ organisations, civil society organisations and their training bodies) as well as national, regional and local authorities. While the focus of the study will be to identify and reflect on policy or strategically driven approaches to cooperation, it will also consider education and business cooperation in a very broad sense, to mean any kind of relevant policy provision and/or formalised or non-formalised interaction between an education/training provider and a business organisation.

The current paper relates specifically to the situation in Israel. It has been elaborated as a self-assessment, and follows a study method that consists of desk research, data collection and working group meetings. During this intensive consultation process, which was facilitated by ORT Israel, the main national stakeholders (representatives from relevant ministries, social partners, the education system, businesses and civil society) discussed the current situation and put forward recommendations for its improvement. Based on the key discussion points and messages, Dr Eli Eisenberg and Osnat Hachmon from ORT Israel produced this report. A final dissemination seminar was planned for October 2010.

The current paper will serve as an input for a regional ETF study that is relevant for the context of the European Neighbourhood South Partnership Instrument region and for a cross-country ETF study of education and business cooperation (examining the findings of all countries with which the ETF cooperates); these are both due to be published in the spring of 2011.

LIST OF ABBREVIATIONS

CEO	Chief Executive Officer
ETF	European Training Foundation
EU	European Union
HR	Human Resource
IAESI	Israel Association of Electronics and Software Industries
IDF	Israel Defence Forces
IPLMA	Israel Purchasing and Logistics Managers Association
ISQ	Israel Society for Quality
IT	Information Technologies
MAI	Manufacturers' Association of Israel
MoE	Ministry of Education
MoITL	Ministry of Industry, Trade and Labor
MoST	Ministry of Science and Technology
NCRD	National Council for Research and Development
R&D	Research & development
SDVTHR	Senior Division for Vocational Training and Human Resource or Senior Division for the Training and Development of Human Resources
SME	Small and medium-sized enterprises
VET	Vocational education and training

1. EXECUTIVE SUMMARY

Israel lies at the south-west tip of the continent of Asia, to the east of the Mediterranean Sea. It covers an area of 22 072km^2. It has a population density of 321 people per square kilometre. On 31 December 2009 the population was estimated at 7 509 000 inhabitants[1]. The average age in Israel is 29.1 years, and the GPD per capita for 2007 was USD 23 257.

Education in Israel can be divided into four main phases (or levels), according to the age of the learners: primary, secondary, post-secondary and tertiary. The level of cooperation between the education sector and the business sector varies greatly depending on the different age groups of the school children and students.

In recent years there has been a greater awareness of the need for cooperation between the education system and the business sector, the main objectives of which are:

- to enhance and streamline the training of qualified human resources at all levels, in accordance with the changing needs of the business sector;
- to update and adapt the curricula at all levels of education to the needs of industry and of the Israel Defence Forces (IDF);
- to encourage specific population group (girls, Arabs, ultra-orthodox Jews) to work in the manufacturing sector;
- to promote the transfer of knowledge from academia to industry, and vice versa;
- to introduce students at all levels to the experience and activities of the business sector and to encourage them to integrate into the workforce in the future.

Cooperation between primary schools and the business sector is currently conducted mainly through Taasiyeda[2] in conjunction with the Ministry of Education (MoE) and the Ministry of Industry, Trade and Labor (MoITL). These activities are partly funded by the schools, which do not receive any special budget for this purpose.

In recent years there has been a significant change both in secondary schools and in the business sector regarding their understanding of the need for mutual cooperation. The Manufacturers' Association of Israel (MAI) has significantly increased its involvement in the area of technological-vocational training, and at the same time the MoE has sought to promote and increase the number of students in technological-vocational education. Nevertheless, there are currently no government incentives to encourage industries and employers to establish cooperative projects with secondary schools; any cooperation that does take place is still mainly at the instigation of a particular manufacturer, and is a local activity rather than one based on an organised, ongoing, long-term process.

In post-secondary education, most vocational training in Israel is conducted following national army service; it is funded and supervised by government bodies (mainly the MoITL) and non-governmental bodies and associations (such as JDC-Israel[3]), and executed by the technology education networks and private training companies. Despite the great need for the involvement of the business sector to promote and develop the human resources of Israeli society in relation to areas of its economic growth, and to increase the participation of women, Arabs, ultra-orthodox Jews and people with disabilities in the labour market, it is difficult to find businesses that are ready to cooperate. Similarly, there is no coordination between the needs and demands of employers and the supply in the labour market, and the involvement of the partner companies is very limited.

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1 Population estimates do not include foreigners residing in Israel.

2 Taasiyeda is an educational, non-profit association of the Manufacturers' Association of Israel.

3 American Jewish Joint Committee.

Cooperation between tertiary education and the business sector takes place on two main levels: mentoring students, and promoting R&D in both tertiary education and industry. The mentoring of students by managers and developers in industry gives students practical experience in large-scale project execution, as part of a development project at a manufacturing plant. The enrichment of the knowledge and skills of students and of university/academic college faculty members depends mainly on the personality of the person in charge of community relations in the company rather than on a uniform policy. These activities are usually local and short term.

Israel, its business sector and its tertiary education institutions attach great importance to promoting R&D in tertiary education. This sense of importance is reflected in the establishment of 'applications companies' at universities, and also more recently in academic colleges, in which joint R&D activities with the business can take place. Government activity is extensive and includes encouraging initiators of innovation and providing financial support to new initiatives through various programmes, one of the more prominent of which is the MoITL R&D project 'Technological Initiative Incubators'. This programme is a great source of interest for many countries that wish to learn from its successes, including Sweden, Australia, New Zealand and the USA.

Despite the advantages and benefits inherent in cooperation between education systems and the business sector, there is still no legislated, budgeted overall policy (for any of the levels of education) with proper control or assessment for such cooperation, and there is no single inter-ministerial body to unite and guide these types of cooperation.

The key recommendations of the report are:

1. to create a legislated inter-ministerial body to institutionalise the various activities of cooperation at every level of education with the business sector, and to provide this body with a long-term budget;

2. to reduce governmental bureaucratic procedures;

3. to ensure the efficient use of all the available resources, governmental and otherwise, and the rational utilisation of human resource potential in order to close gaps between supply and demand, and between the needs of employers and trained human resources.

2. CONTEXT

The following sections provide general data about Israel, its education systems and its business sector that are relevant for potential cooperation between education and business (Artzav, 2009).

2.1 Israel

Israel lies at the south west tip of the continent of Asia, to the east of the Mediterranean Sea. It covers an area of 22 072km^2 (ex cluding Gaza, Judea and Samaria). Its population density is 321 people per square kilometre. On 31 December 2009 the population was estimated to be 7 509 000 inhabitants[4]. Of these, 5 664 000 (75.4% of the total population) are Jews, 1 526 000 (20.3%) are Arabs and 319 000 (4.3%) are others[5].

The average age in Israel is 29.1 years and the GPD per capita for 2007 (based on exchange rates) was USD 23 257.

4 Population estimates do not include foreigners residing in Israel.

5 'Others' refers to immigrants and their families who are not registered as Jews with the Ministry of the Interior (non-Arab Christians and residents with no religious classification).

Table 1: Expenditure by government, national institutions and local authorities, by purpose

	2008	2007	2006	2005	2004	2003	2000	1995
Total in ILS millions	**311 434**	**301 609**	**291 072**	**273 361**	**269 579**	**272 281**	**240 159**	**149 754**
General services	40 807	44 822	43 037	42 270	43 339	43 570	38 128	25 070
Defence	51 529	50 329	50 620	46 745	45 020	47 302	40 331	25 118
Public order	12 335	11 673	10 971	10 395	9 941	9 644	8 081	4 484
Economic services	21 787	20 751	21 142	16 884	18 203	17 482	16 204	13 475
Quality of environment	4 616	4 303	4 060	3 800	3 655	3 653	3 133	2 073
Housing & community services	3 653	3 981	4 332	4 797	3 920	5 038	4 373	5 231
Health	32 800	30 481	29 197	28 296	27 211	26 903	24 355	15 100
Culture & religion	9 707	9 318	8 883	7 857	7 763	8 491	7 858	5 118
Education	51 394	48 656	45 118	42 385	41 541	40 255	37 269	22 137
Social insurance & welfare	82 805	77 295	73 711	69 932	68 986	69 942	60 427	31 949

The national expenditure for education for 2007 was 7.4% of GPD (a higher rate of investment than that in OECD countries, which is 6.2%).

Table 2: Civilian R&D funding by government ministries, by target[6]

Percentages								
Target	2008	2007	2006	2005	2004	2003	2002	2001
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Soil studies and exploitation	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.4
Infrastructure development	1.2	1.2	1.1	1.2	1.7	0.5	0.5	0.7
Quality of the environment	1.0	1.0	0.9	1.0	0.9	0.8	1.0	1.0
Health	0.9	0.9	0.8	0.8	0.8	0.6	0.7	0.7
Energy production and uses	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3
Agriculture, forestry and fishing	7.5	8.0	7.4	7.6	7.8	6.5	6.6	7.2
Promoting industrial technology	36.0	33.1	35.6	34.0	35.7	39.4	34.2	37.4
Social services	4.5	4.6	4.9	4.4	5.1	5.4	5.2	4.8
Space studies and exploitation	0.4	0.3	0.2	0.3	0.0	0.0	0.1	0.1
University foundations and PB[7]	44.7	47.2	45.7	47.2	44.5	43.5	46.5	43.4

6 Targets – as recommended by the OECD.

7 PB – The Planning and Budget Committee of the Council for Higher Education.

General promotion of research	3.4	3.2	2.9	3.1	3.1	2.8	4.5	4.0

Total national expenditure for civilian R&D for 2008 was 4.7% of GDP, or USD 1 259 per capita (a higher rate of investment than that in OECD countries - Austria: 2.7, Finland: 3.7, Sweden: 3.6, Germany: 2.6, Holland: 1.8).

2.2 Sociocultural context

The education system in Israel is heterogeneous in terms of its structure and budgeting, as well as in the fact that there are many kinds of educational institutions suited to the needs of the country's different populations. Education in Israel can be divided into four main phases (or levels of education) according to the age of the learners:

4. **pre-primary education**: for children between the ages of 3 and 6 (3–4-year-olds in pre-pre-compulsory kindergarten; 4–5-year-olds in pre-compulsory kindergarten; 5–6-year-olds in compulsory kindergarten);

5. **primary education:** 6 years of schooling (there are a small number of institutions where this is 8 years) for ages 6–12;

6. **secondary education:** includes junior high school and senior high school:

    - junior high school: following primary school, this covers grades 7–9 (ages 13–15);

    - senior high school: following junior high school, this covers grades 10–12 (ages 16–18);

7. **post-secondary and academic studies:** ages 18 and over:

    - post-secondary: study towards a non-academic certificate focusing on practical, technical or vocational skills to facilitate direct integration into the workforce; in post-secondary institutions individuals study for diplomas to become, for example, registered nurses, property appraisers, technicians and practical engineers; post-secondary education includes students in grades 13–14 in technology education under the supervision of the MoE, and students in technology training institutes (TTI) under the supervision of the MoITL;

    - academic education: academic studies for undergraduate, Master's and doctoral degrees recognised by the Council for Higher Education; these studies take place at universities, the Open University, academic colleges and academic teacher-education colleges.

2.3 Socioeconomic context

Industry in Israel is divided into several branches, the most important of these being hi-tech and bio-tech; diamond polishing; chemicals; and food and beverages. Over time, hi-tech industries have expanded and are now central to most of the growth areas within Israeli industry.

- In 2007 the participation rate in the Israeli workforce stood at 56.3%. This compares with 66.0% in the USA and 48.6% in Italy (US Department of Labor, 2009).

- The highest proportion of those employed (around 20%) are in the service sector; of the country's 2.7 million workers, over half a million are employed as agents, in sales and in service provision.

- Israel is highly heterogeneous and has particularly low workforce-participation rates in specific populations such as minorities, ultra-orthodox Jews and women (42.0% for Israeli Arabs and 51.3% for women).

- The higher the level of education, the greater the level of participation in the workforce. The data also indicates that there has been an academisation of the workforce and workers with at least 16 years of education keep working for longer time.
- Industrial export (Ginel, 2007): There has been a sharp acceleration in the growth of industrial exports (excluding diamonds), which reflects a rise in exports in all branches of industry, but which derives almost entirely from a rise in branches of elite technologies.

3. NATIONAL POLICIES

The achievements of Israeli industry are to a large extent the product of the country's education systems and its investment in R&D. The reciprocal relations between formal education and the constantly changing knowledge that emanates from the business world pose challenges in terms of the nature of the links between the education systems and the business sector. There is an obvious need for ties to be forged with industry and with those sectors that apply professional training in practice, in light of the fact that contemporary industry is based on advanced equipment and complex, sophisticated technological processes and on a resource-rich work environment.

3.1 Ministry of Education – Science and Technology Administration

There is currently a general consensus on the need for fruitful, high-quality cooperation between the education system and the business sector, with the following aims (Ministry of Education, 2009, 2010):

- to streamline and optimise the vocational/professional training of personnel at all levels according to the changing needs and demands of the business sector;
- to update and adapt the curricula in technological and vocational study tracks to the workforce needs of industry and the IDF in terms of both quantity and quality;
- to update and adapt the study tracks for technicians and practical engineers (grades 13–14) to cater to the needs of industry and the IDF;
- to encourage specific populations (girls, Arabs, ultra-orthodox Jews) to work in industry;
- to prepare the continuing education infrastructure for the levels of training and degrees required by the business sector;
- to adapt technological/vocational education to international standards.

The policy of cooperation with the business sector is established at the national level and includes national goals for regional and local levels, in accordance with the profiles and needs of vocational/professional personnel in the economy and the local business sector.

All partners – ministries, the MAI and the technology education networks – share in the initiation of this cooperation. Collaboration takes place mainly in secondary schools (junior high and senior high) and in post-secondary institutions (for technicians and practical engineers).

The business sector partners are mainly from the mechanical, electrical, electronics and computer industries. Cooperation is not time-limited, but rather is an ongoing systemic process.

3.2 The Ministry of Industry, Trade and Labor

The MoITL undertakes both vocational training and R&D activities in relation to cooperation between the education systems and the business sector.

3.2.1 Vocational training (Ministry of Industry, Trade and Labor, 2010a, 2010c)

The Senior Division for Vocational Training and Human Resources (SDVTHR) initiates, plans and executes a wide range of training activities in order to cater for the employment needs of various population groups.

The SDVTHR operates a secondary education framework. This provides technical vocational training within the framework of the authority granted by the Educational Law (1953) and the Youth Labor Law (1953). In accordance with the Apprenticeship Law (1953), certain professions are acquired through apprenticeship, a combination of study and work. Students study for three days a week and work for two or three days a week.

In addition, the SDVTHR operates an education framework for adults (aged 18+). The objective of vocational training for adults is to cater to professionals and non-professionals alike who wish to learn a trade or change to a new one, or to upgrade their existing trade in order to improve their chances of employment and earnings.

Vocational training is conducted within several frameworks:

- government training centres;
- vocational schools and technology colleges;
- on-the-job training in factories and on construction sites;
- individual training;
- promoting women and working skills;
- transferring from vocational to academic studies.

Apart from that which is conducted in government-run centres, all training is delivered by the technology education networks and other bodies involved in vocational training in Israel. In recent years, following the government policy of privatisation, government-run training has been reduced and transferred to the private sector.

3.2.2 The Office of the Chief Scientist (Ministry of Industry, Trade and Labor, 2010a; Chief Scientist's Office, 2010)

The Office of the Chief Scientist is responsible for the development of knowledge-intensive industries by encouraging technological and industrial innovation and the creation of technology-based jobs. It also encourages industrial R&D in Israel through a series of special programmes, the purpose of which is to encourage entrepreneurs and industries to participate in high-risk technology projects in which the risks are shared with the government.

In addition, the office works to promote the transfer of knowledge from academia to the industry and business sectors. In 2005 it launched a new programme to support university R&D centres in creating a technology infrastructure using their existing databases and talent. The programme fulfils the need to continue to develop products for the Israeli economy as well as to maintain and strengthen Israel's position at the forefront of science and technology internationally. Furthermore, the office runs a programme aimed at increasing the mutual cooperation between industry and universities and advancing the potential application of academic research.

3.3 The Ministry of Science and Technology: The National Council for Research and Development (NCRD, 2009a, 2009b)

The National Council for Research and Development (NCRD) advises the government on the formulation of policy that will make use of Israel's existing civilian science and technology knowledge base and develop it further. The NCRD is required to examine existing R&D systems, to alert the government of any failures, to identify needs and to recommend a comprehensive policy for the issues under its jurisdiction.

The council is the sole body that provides the government – and the public – with a macro view of R&D from a national perspective rather than from the perspective of a particular ministry or sector. In 2008 the Special Committee on the Links between Industry and Tertiary Education was set up as part of the activities of the NCRD; it focuses on the following issues:

- setting overall national policy regarding the process of transferring knowledge from university to industry, with reference to the issues of intellectual property;
- setting overall national policy regarding the securing of public resources for the enhancement of the knowledge generated within universities in anticipation of its transfer to industry;
- identifying and testing ways to efficiently transfer knowledge that has potential for application from university to Israeli industry;
- establishing criteria to ensure the existence and development of the basic research frameworks at university;
- coordinating programmes and suggestions for developing ways of implementing and commercialising the knowledge generated at university;
- formulating plans for the government's role, using the tools at its disposal (budgets, taxation and legislation), in influencing the process of the transfer of knowledge from university to industry.
- formulating plans for industry input into the development of teaching subjects and research infrastructure within universities;
- setting criteria for the management of intellectual property and copyright arrangements.

It should be noted that the committee has not yet completed its work; it published an interim report in June 2009. Some of the committee's objectives and challenges regarding the cooperation between tertiary education and the business sector are mentioned elsewhere in this study.

3.4 The Manufacturers' Association of Israel

The MAI is the sole representative organisation of the manufacturing sector as a whole in Israel (Department for Technology Education and Vocational Training, 2010; MAI, 2010). As the representative of the largest organisation of employers in the country, the MAI is a major partner in macro-economic decisions and in labour relations arrangements.

Given Israel's lack of natural resources, science, technology and IT are its strategic assets. The country must therefore invest in its future by ensuring it has a generation of young people who have high-quality education, creativity and imagination, and who will be able to serve the country's societal and economic needs (Department for Technology Education and Vocational Training, 2010). Graduates of technology education – those from technology tracks in high school, those who are technicians and practical engineers, and those with university or college engineering degrees – are the individuals who have led Israel's industry throughout its existence. It is these individuals who have enabled the development, manufacture, maintenance and export of defence and civilian

manufacturing to take place, both for elite technologies such as electronics, mechatronics and computers, and for mixed and traditional industries such as plastics, metals, textiles and food.

Hence the MAI seeks to set processes in motion, initiate, and actively partner the education system in general, and secondary and tertiary technology education in particular. This is based on the belief that investment in education – particularly science-technology-engineering education – is critical for the retention of Israel's competitive edge in the global market, as well as for its own socioeconomic resilience.

The areas of cooperation between the education system and industry are broad and diverse. Some cooperation is local (the initiative of a plant, company, school or college), some regional and some is established at national level, usually involving government offices along with the manufacturing and business sectors.

Industries and the MAI cooperate in many ways with different target populations. Their work with students is diverse, including activities at the level of primary and junior high school and of senior high school in secondary schools and academia. There is also cooperation and involvement in programmes dedicated to strengthening the ties between teachers, head teachers and industry CEOs. The scope and duration of these activities vary, ranging from one-day, one-off activities, to year-long or even multi-year programmes.

4. COOPERATION BETWEEN THE EDUCATION SYSTEMS AND THE BUSINESS SECTOR

There are many forms of cooperation between the education systems and the business sector, according to the age and level of the students. The following reviews of selected examples of cooperation are presented by level of education, starting from primary education and moving up to secondary, post-secondary and tertiary education.

4.1 Cooperation between primary education and the business sector

Cooperative activities between primary schools and the business sector are conducted mainly through the Taasiyeda, the educational non-profit association of the MAI.

Taasiyeda activities for the most part involve visits and field trips to industrial premises, projects, and competitions in which students create, initiate and invent technology tools and products to solve problems that occur in everyday life, while becoming familiar with the engineering design process (Department for Technology Education and Vocational Training, 2010; Taasiyeda, 2010).

In 2009 over 80 000 students around the country learned about industry through long-term activities consisting of between 8 and 16 one-day sessions. These took place at schools, at workplaces, and at specific training centres that promote the various branches of manufacturing (e.g. electronics, mechanics, food, textiles, chemicals and medicine). Such activities are fully coordinated with the MoE and the MoITL, with shared (though partial) funding for their development provided by the Science and Technology Administration of the MoE, the MoITL and manufacturing industries.

4.1.1 Examples:

1. Cultivating entrepreneurship (Department for Technology Education and Vocational Training, 2010): This is a key area for Taasiyeda in terms of primary and junior high school students. Taasiyeda runs a number of programmes designed to encourage an entrepreneurial approach, to foster inventive thinking and technological understanding, and to improve knowledge of development processes in manufacturing. Developing products within the framework of these programmes follows the development processes in the various branches of industry, from the initial definition of the problem

and the need it represents, to the application of technology-based solutions to the problem, and the marketing of the final product.

2. FIRST LEGO League (FLL) (MAI; FIRST LEGO League, 2010): This is an international robotics programme for children between the ages of 9 and 14. The students study and solve a concrete problem based on a challenging topic, present their research and solutions, and build an autonomous robot using engineering concepts. The programme encourages children to think like scientists and engineers. It provides a creative learning experience that involves active participation during which students experience and overcome obstacles, gain confidence and self-esteem, and engage with science and technology. The FLL programme was established in Israel in 1998 and is the outcome of a partnership between the FIRST Association and the LEGO Group. So far, the FLL has reached over 90 000 children in 45 countries around the world.

In 2006, 55 teams from Israel took part in the FLL programme, with over 550 students.

4.1.2 Assessment

Each activity is subject to an assessment, including of the instructor, of the level of participation in the class and of the resources available (e.g. computers, equipment).

As yet, no follow-up has been undertaken on the subsequent level of participation in technology and engineering studies of students involved in the Taasiyeda activities.

4.1.3 Outcomes

The activities have offered exposure to industry and have raised awareness among primary and junior high school children as they choose their areas of study in senior high school, and later in their post-secondary education.

4.1.4 Challenges

Some schools have had difficulty participating in the activities because of problems in raising funds.

4.2 Cooperation between secondary education and the business sector

Today there is consensus among government agencies that cooperation between the business sector and secondary education is crucial for revising curricula to make them more relevant to developments in industry. Furthermore, there is an understanding that school students should be exposed to industrial developments at an early age in order that they are motivated to choose technological-scientific-vocational subjects in their future studies.

4.2.1 Examples

1. The Technician and Matriculation Programme (Tech-Mat) (Department for Technology Education and Vocational Training, 2010; ORT Israel, 2010b): This is an initiative of the ORT Israel network (see Appendix 3) and the MAI. The Tech-Mat programme, which operates under the supervision of the MoE, allows students to obtain both a matriculation certificate and a technician diploma at the end of the 12th grade in those subjects required by industry: electrical engineering, mechanical engineering and electronics. The purpose of this programme is to increase the number of students in technological education. It involves exposure workshops and marketing activities for students and their parents.

Each school has its own ‘adopting’ industrial enterprise whose purpose it is to accompany the class during the four years of study (9th–12th grades). The adoption activity is varied and includes pedagogical/vocational aspects as well as social/community activities, such as lectures and study trips

for students and teachers, supervision and professional advice on the final projects, and mentoring and individual assistance for struggling students.

El-Op Ltd's adoption of ORT Afridar, Ashkelon, is an example of best practice of cooperation in the Tech-Mat project. This case was presented at the EU Conference held in Brussels on the subject of 'Education–Industry Cooperation' in December 2009, and received very positive response (see Appendix 5 for more details) (El-Op Ltd, 2009; ORT Afridar, 2009).

The Tech-Mat programme was launched 5 years ago in 9 schools with around 200 students, and is currently running in 100 schools with around 3 200 students. The target is to reach 10 000 students.

The programme includes a number of Arabic-speaking schools, and this is part of the national effort to enable graduates of technological education from the Arab population to become better integrated into the labour market in the future.

As the driving force behind the Tech-Mat programme, the MoE finances the study hours and the equipping of laboratories, but not the activities with the adopting enterprises.

Partners: The MoE, the MAI, the technology education networks and the IDF.

2. The MoITL Apprenticeship Law (Ministry of Industry, Trade and Labor, 2010a; Department for Technology Education and Vocational Training, 2010): Within the scope of this law, organised national activities take place between the business sector and industry on the one hand and the secondary schools under MoITL supervision on the other. Activities take place through vocational-industrial secondary schools, with around 13 000 students participating from all sectors of the population – Jewish, Muslim, Druze, Bedouin and Christian – who have been unable to adjust to the schools that are within the MoE's remit.

Under this arrangement, students are accepted for paid work by industrial enterprises in a dual-education framework (three days' study and three days' work). At the age of 16, they have already been exposed to the world of employment in industry and services. The programme is financed by the MoITL.

Partners: The MoITL, the technology education networks, industrial enterprises.

3. Cooperation between head teachers and managers in the business sector: Projects such as 'Managers Adopting Heads' and 'Meeting Point' aim to create productive dialogue, mutual recognition and proximity at the personal and professional level between head teachers in the education system and managers in the business sector, to recognise the needs of both organisations and to create cooperation (for more information see Appendix 5) (Ministry of Education, 2010; ORT Israel, 2010a).

4. In-service courses for technology teachers: This is an MAI initiative in which technology teachers are given continuing education courses at industrial enterprises around the country. These courses introduce teachers to work procedures and highly advanced industry technologies in various fields, such as electronics, and electrical and mechanical engineering (Department for Technology Education and Vocational Training, 2010; Taasiyeda, 2010).

The programme was launched during the 2009–10 school year and involved some 20 teachers from ORT and AMAL (see Appendix 4 for details of the AMAL network). During the 2010–11 school year it is to be expanded to include some 60 teachers from around the country. The programme is being funded by the technology education networks and the MAI.

Partners: Taasiyeda, ORT and AMAL education networks.

5. Cooperation with international industries:

- The Net@ Cisco project (Net@, 2010): The purpose of this programme is to change the course of the lives of young people aged 14–18 in the geographic and social periphery of the country, with the aim of transforming them into the 'dream team' of Israeli hi-tech industry.

- IBM (ORT Isreal, 2010a): Encouraging science and technology among ORT Israel students. For more details see Appendix 5.

For more examples see Appendix 5.

4.2.2 Assessment

To date there has been no assessment of existing levels of cooperation. Nevertheless, there is an understanding that quantitative (number of graduates) as well as qualitative (knowledge, skills and values acquired) benchmarks should be set. Furthermore, there is a need to ascertain the number of students who continue their studies to become technicians and practical engineers and the number who go on to engineering studies. The commitment of everyone involved (students, teachers, managers, industrial employees) and the motivation to achieve successful cooperation also should be ascertained.

4.2.3 Outcomes

The cooperation between secondary education and the business sector has achieved the following outcomes:

- exposing young people to what goes on in industry and creating interest and awareness in choosing study subjects and future employment;
- increasing the cadre of scientific-technological human resources;
- creating a partnership in which industrial personnel are involved in study content and are making it more relevant and up to date for industry and the IDF;
- providing opportunities for the professional advancement and development of science and technology teachers;
- providing a solution for students with a technological orientation.

4.2.4 Challenges

- Most of the cooperation is undertaken on the basis of the adopting company's social commitment rather than from the viewpoint of the benefits that may be derived from such cooperation. Some companies avoid long-term commitments, and most of the cooperation is based on the personalities of the contact personnel at the company. Furthermore, it is difficult to find committed personnel within both the school and in the business enterprises to arrange such cooperation.
- It is difficult to find adopting companies for Arab schools.
- Such cooperation is inhibited, or even prevented, by enterprises' safety requirements and their reluctance to admit students to gain practical experience on expensive industrial systems (Ministry of Education, 2010).
- Sometimes the secondary education and business enterprises have different expectations of the cooperation, and this leads to difficulties in implementation.
- Identifying a budgetary source to finance activities with the business sector can be a challenge, especially in terms of funding the transport costs of students.
- There is no 'guiding hand' from the government that dictates top-down policy to encourage employers by giving incentives to participate in cooperation programmes and projects with schools.

4.3 Cooperation between post-secondary education and the business sector

The majority of professional training in Israel is undertaken after military service through government agencies (primarily the MoITL), NGOs (such as JDC-Israel) and various other bodies. The emphasis is on training workers from those populations that are not sufficiently represented in the workforce, and on removing the barriers that have prevented their integration.

In recent years, the MoITL's SDVTHR has emphasised the training of specific populations: those receiving long-term allowances, Arabs (particularly Arab women), ultra-orthodox Jews (particularly ultra-orthodox women), and individuals with a disability.

4.3.1 Examples

1. On-the-job training:

- Training of workers for the industrial and service sectors and for the building industry (Ministry of Industry, Trade and Labor, 2010a): The purpose of these programmes is to integrate unemployed people into the workforce, to reduce the level of unemployment and to offer basic vocational on-the-job training at a factory or building site.

- Training of workers for the hotel industry (Ministry of Industry, Trade and Labor, 2010a): This programme is intended for male and female adults and young people. Its objective is to create a cadre of workers for hotel industry professions. The programme has been running for around three decades and is financed by the government.

For more details see Appendix 6.

2. 'Telem' – Employment, studies and residential accommodation in Kibbutzim (Department for Technology Education and Vocational Training, 2010): This is an initiative of the Kibbutz industry that is aimed at assisting young Ethiopians to integrate independently into Israeli society. The programme was launched in 1998, and provides apprentices with full salary employment and living quarters on a Kibbutz, with study sessions after their working hours are over. It is a one-year programme that is run at 16 Kibbutzim across Israel. Entrants are young men and women up to the age of 24 who have completed their military or national service, but who have not succeeded in their high school studies. Every year around 90 men and women participate in the programme.

Partners: Kibbutz industry and Kibbutzim.

3. ATIDIM[8] for Industry (ATIDIM, 2010): The purpose of this project is to enable young talented people from the periphery who have completed their military/national service, whose academic results have not allowed them to obtain an undergraduate degree and/or those who wish to study to become a practical engineer, to acquire high-quality vocational training and a work placement in a leading corporation.

Students are chosen by the cooperating enterprise and ATIDIM through a rigorous selection process. They undergo intensive training over a period of 17 months, in cooperation with the government TTI, after which they are entitled to receive a practical engineering certificate.

Students receive full funding for their tuition fees and ancillary expenses, and a monthly living allowance (according to socioeconomic tests), are given intensive support by ATIDIM and the participating enterprise on both college and personal matters and, of course, are incorporated into the enterprise as rank and file employees at the end of the course (subject to the enterprise's requirements).

[8] ATIDIM for industry: this is a non-profit NGO which seeks to enable young talented people to acquire high-quality vocational training and a work placement in a leading corporation.

Partners: The MoITL, the MAI, the Unit for the Guidance of Discharged Soldiers, the Gross Foundation, the Hesegim (achievements) programme, the Israel Society for Quality (ISQ), the Israel Purchasing and Logistics Managers Association (IPLMA), tertiary institutions and some 140 adopting enterprises .

4. 'A Woman of Worth'[9]: This programme is for unemployed women, new immigrants from Ethiopia, Kazakhstan and Bukhara, women from the Arab sector and young women who are without family support. Its objectives are to integrate unemployed women into business corporations, to improve and upgrade the nature of their employment and to create opportunities for socioeconomic mobility within the target population.

The programme operates with an approach that is sensitive to cultural family issues, giving women the tools to address personal and family dilemmas associated with finding productive employment.

Partners: JDC-Israel, the Ministry of Immigrant Absorption's Employment Department, the Ministry of Welfare (The Community Employment Service), the MoE, the Ministry of Housing (Neighbourhood Rehabilitation), local authorities.

For more examples see Appendix 6.

4.3.2 Assessment

The primary measure of success for the MoITL's professional training system is the proportion of vocational training graduates who obtain good-quality employment (Ministry of Industry, Trade and Labor, 2010a).

Research undertaken by the Research and Economics Administration at the MoITL has shown that 6 months after completing their studies, 65.8% of the adults are working (39.8% in their chosen profession). This rate increases over time: 2 years after completion of the training it reaches 69.8%; after 5.5 years 73.6%; and after 10 years 82.0% of all graduates. It also indicated that the employment status of those who had undergone training was better than those in the same occupation but without training. This data relates to those individuals who have been referred to the SDVTHR by the employment services when it was found that they could not be placed in employment.

The Tevet[10] company follows its participants over a period of approximately three years in order to identify the strengths and weaknesses of the models they are developing. Of the 45 384 active participants, 18% are ultra-orthodox, 17% are young people, 10% are from minorities, 18% are immigrants, 4% have disabilities and 33% are 'others'; 59% are women and 41% are men. Furthermore, 53% of the participants have completed 11–12 years of study, while 22% have completed 13–15 years. Around 61% of the graduates from the programme are working, while another 5% are enrolled in courses or in the army.

4.3.3 Outcomes

The cooperation between post-secondary education and the business sector has achieved the following outcomes:

- removing sections of the population from the cycle of poverty and fostering individuals' ability to earn a stable living over time by integrating these groups (men and women) into the labour market;
- improving the attitudes of the target populations towards work;
- changing society's attitudes to people with disabilities;

[9] Details on 'A Woman of Worth' and 'From Poverty to Independence' (see Appendix 6) as well as additional activities of the JDC-Israel were taken from http://www2.jdc.org.il/category/employment-programs-alphabetic, which lists a range of programmes aimed at improving employment prospects.

[10] The Tevet company (An Upswing in Employment) was founded by JDC-Israel, whose website is: http://www2.jdc.org.il/category/Tevet

- providing suitable facilities for the purpose of acquiring practical experience and familiarity with innovative and up-to-date equipment;
- assisting companies to admit students for periods of practical work experience and to place apprentices during the course of their apprenticeship;
- assisting improvements to the training system by providing ongoing feedback on the quality of graduates and their suitability for the needs of employers.

4.3.4 Challenges (Ministry of Industry, Trade and Labor, 2010a)

Such cooperation presents a number of challenges.

- There can be difficulties in finding businesses to cooperate with training organisations.
- Cultural barriers exist for sections of the population that have low rates of participation in the labour market and high levels of poverty (ultra-orthodox men and Arab women), and these create obstacles to accessing vocational training.
- Government support for vocational training for the stronger elements of society has reduced greatly, and therefore government-sponsored training that is funded through the MoITL's SDVTHR relates to a very small proportion of the target population: those receiving long-term allowances (primarily those receiving income maintenance allowances), Arabs (particularly Arab women), the ultra-orthodox (particularly ultra-orthodox men), and individuals with disabilities.
- There is a very limited level of involvement on the part of employers in the field of vocational training, particularly adult training. Employers in general do not, of their own volition, enter into partnerships with the government for the purposes of determining the needs of the economy in vocational training. Cooperation is undertaken on an ad hoc basis for the purpose of fulfilling the requirements of each individual employer, and this is almost always dependent on government financing.
- There is no correlation between the needs and demands of employers and the supply in the labour market. For example, there has been no attempt to address the need for workers in labour-intensive manufacturing sectors such as construction and agriculture, because these sectors suffer from low salaries and a negative image, and have the option of hiring unskilled foreign workers.

4.4 Cooperation between tertiary education and the business sector

Universities and academic colleges work on two main levels of cooperation with the business sector:

- student mentoring;
- developing R&D.

4.4.1 Examples

1. Establishing an applications company at a university/academic college (Hayadan, 2010): The applications company constitutes an interface between the university or academic college and the business sector. For the purposes of commercialisation of intellectual property, universities and academic colleges establish units that are responsible for finding ways to turn patents into products that are of general benefit. These units try to find business enterprises who will purchase licences to

use the patents that are the output of tertiary education, and will develop the technological ideas and turn them into saleable products.

The units that have been established in Israel are considered to be world leaders in the commercialisation of intellectual property created in academia. This is the result of a very rich pool of intellectual property and years of professional and systematic work in locating potential franchisees and closing licensing deals. The top dozen academic institutions in the world for revenue from intellectual property include the Weizmann Institute of Science in Rehovot (through the Yeda Research and Development Company) and the Hebrew University of Jerusalem (through the Yisum Research and Development Company at the Hebrew University of Jerusalem).

The main thrust of applications companies in Israel is the commercialisation of technologies in medicine, biotechnology and medical devices. For example, of the 26 commercialisation agreements signed by the Ramot Tel Aviv University Affiliation in 2007, 10 were for medicines, biotechnology and agricultural products and 5 were for medical devices, diagnostics and research products. Of the 10 bio-medical agreements, 67% were made with foreign companies and 33% with Israeli companies. Three of these agreements were made with start-ups that were established especially to utilise technology developed in academia.

Israel's well-known successes in bio-medical technologies include the drugs Copaxone and Rebif for the treatment of multiple sclerosis, and Erbitux for cancer, all from the Weizmann Institute of Science, and Exelon for Alzheimer's disease and Doxil for cancer from the Hebrew University.

It is worth noting that apart from the universities, until three months ago the ORT Braude Academic College was the only institution to have an applications company: this is called Ofek Eshkolot, and was established two years ago (Ministry of Industry, Trade and Labor, 2010b). The first conference on encouraging research at academic colleges was held recently.

2. Technological Initiative Incubators (Ministry of Industry, Trade and Labor, 2010b): Incubators for technological initiatives provide support for entrepreneurs who have innovative technology ideas to enable them to develop their concept into a commercial product and start a new business for that purpose. It is a national programme supervised and managed by the Office of the Chief Scientist of the MoITL.

The technological incubators deal with the earliest phase of the initiative: they help new entrepreneurs to realise their ideas and turn them into a commercial product destined mainly for export, and to set up a manufacturing business company in Israel. This stage involves a significant level of risk, which the private sector is not usually willing to take. Thus, in order for good ideas not to be lost, in this programme it is actually the state that takes the risk that the commercial investor is unwilling to take, and the state that finances the critical development stage. The technological initiative incubators provide entrepreneurs with the space, financial resources, tools, professional advice and administrative help to allow them to turn an abstract idea into a viable product that has proven advantages and for which there is a need in the international market. The incubator period substantially increases an entrepreneur's chances of securing private investment, forging a strategic partnership and leaving the incubator as an independent company.

The programme's policy is set by the Committee for Technological Initiative Incubators, whose members are appointed by the managing director of the MoITL. The committee comprises:

- Chief Scientist of the MoITL – chairperson;
- Deputy Chief Scientist;
- four representatives of technologically advanced industries;
- Treasury representatives;
- director of the Momentum programme;
- MoITL accountant;
- director of the Technological Initiative Incubators programme.

During the incubator phase the state provides most of the budget for the project, and thus, the government-appointed management of the incubator is accountable for the proper, efficient management of every project in the incubator, including budgeting and commercialisation of the project. The agreements relating to government support for the incubator projects are signed by the incubator administration. The funds supporting both the administration of the incubator and the projects themselves are transferred to the incubator.

Projects may remain in the incubator for a maximum period of two years. During this time the entrepreneur should have reached a point at which there is a clearly defined product with proven technological and marketing feasibility, a working product prototype and an organised business plan so that the project is ready for commercial investment and/or the addition of a strategic partner with experience in the field. At the end of the two years, the entrepreneur must be able to continue independently. The budget for each project ranges from ILS 1.4 million and ILS 2.5 million (between EUR 0.28 million and EUR 0.5 million), with 15% funded by the incubator and 85% by the government.

As of now, there are 26 technology initiative incubators across the country, each receiving between 100 and 500 applications a year. Each application is screened conducted by a committee, and at the end of this process some 80 applications are approved. At any given time there are around 200 projects running in the incubators.

The success of these incubators is measured by the level of private sector investment rather than the investment of the incubators in their projects. To date, the state has invested USD 0.5 billion, while the private sector has invested more than USD 3 billion. At the end of the incubator period, some 60% of the projects succeeded in finding private investment to enable them to continue the venture. There are claims that the incubators, some of which are located in peripheral areas such as Kiryat Shmona and Dimona, help to improve the socioeconomic mobility of local populations, creating new jobs and improving the general socioeconomic status of the area.

3. Government support frameworks of the Chief Scientist's Office of the MoITL:

- The MAGNET[11] programme (MAGNET, 2010; ORT Braude, 2010; Technion, 2010a): The goals of the project are 'to strengthen and expand the technology infrastructure of Israeli industry, both by local development of pre-competitive generic technologies and by circulation and assimilation of generic technologies developed in Israel and overseas'.

- The NOFAR project (ORT Braude, 2010; Technion, 2010a): The purpose of the NOFAR programme is to increase the application potential of academic research studies by providing opportunities and guiding them towards industrial fields in which there is economic potential.

For more details see Appendix 7.

4. Encouraging young adults to acquire high-level tertiary education:

- High-tech Horizons (Ofakim) – engineers from the periphery (MAI- Department for Technology Education and Vocational Training, 2010; Technion, 2010a, 2010b; Ben Gurion University, 2010; 'Ofakim for Hi-tech', 2010; This is a programme designed to offer equal opportunities to discharged soldiers from the periphery to enable them to acquire academic education in science and technology. Its purpose is to create a cadre of qualified human resources from the periphery and thereby strengthen the area and bridge the gaps between the periphery and the centre of the country.

- ATIDIM for industry and business (ATIDIM, 2010): This is a programme that is designed to identify young adults (aged 21–30) from the country's social and geographical periphery and help them to acquire high-level tertiary education and to integrate into industries and businesses in Israel.

For more details see Appendix 7.

5. Student internships in commercial companies:

[11] MAGNET – Hebrew acronym for Generic Technology R&D.

- Microsoft (Microsoft Israel, 2010): The goal of the programme is to improve scholastic quality in order to engender a higher level of professionalism among faculty staff. The students are not obliged to work at Microsoft on completion of their studies, though the programme enables Microsoft to reach the best people and create the image that it is a worthwhile place to work.

- ORT Braude College of Engineering (ORT Braude, 2010): The purpose of the programme is to promote and develop the level of up-to-date, relevant teaching and learning at the ORT Braude Academic College.

For more details see Appendix 7.

6. Bronica Entrepreneurship and Innovation Centre at the Technion University in Haifa (Technion, 2010a): This centre within the Faculty of Industrial Engineering and Management was established to enrich the entrepreneurial culture at the Technion and to encourage technological initiatives. Activity at the centre focuses on three areas, namely teaching, research and helping entrepreneurs in order to encourage the creation of technological ventures and to strengthen ties between tertiary education and industry.

The Entrepreneurship and Innovation Centre was established to serve the Technion's students, graduates, faculty staff and researchers. Its board of directors consists of 13 members from the Technion, industry, venture capital companies and the technology encubators.

The goal of the centre is to help entrepreneurs to promote their ideas through all stages of the venture's development, through:

- ongoing guidance from the centre's experienced staff;

- contact with advisers from various fields in industry;

- assistance in seeking sources of funding, courses, conferences and lectures by manufacturers in the fields of the various ventures;

- access to databases to enable entrepreneurs to become familiar with and analyse the market;

- comprehensive information on the entrepreneurial process, including referrals to selected websites and professional literature.

The flagship activity of the centre is BizTEC – the national entrepreneurship challenge of students from the Technion, other universities and colleges. What began as an initiative of the Technion now serves over 15 campuses around the country, and is an exclusive gateway to the prestigious Intel Entrepreneurship Challenge. BizTEC, the outcome of cooperation between the Technion and *TheMarker*[12], is a platform for students to learn entrepreneurship competitively, and its aim is to provide the knowledge and assistance required as part of the structured process throughout the academic year. In this contest, five winning teams are selected, and are awarded prizes worth over ILS 100 000 (equivalent to EUR 20 000). Partners in this contest are tertiary institutions, business enterprises, law offices, technology incubators and venture capital companies. Over 6 years, BizTEC has helped to establishing and support 13 companies who produce everything from software for organisations and biotic fuels to medical devices.

For more examples see Appendix 7.

4.4.2 Assessment

The director of MAGNET felt it necessary to conduct an evaluation survey from which the following findings emerged (MAGNET, 2002).

The contribution of the MAGNET programme to industry has related mainly to the building of a technology infrastructure on which various products could be developed. Building this infrastructure

[12] *TheMarker* is the leading economic and business magazine in Israel. It deals with such issues as management, careers, entrepreneurship, small businesses, the money market and finance management, marketing and innovation.

was defined in the questionnaire as ‘gathering and developing knowledge’, and was ranked as the most important issue for a company in the MAGNET programme.

For more details see Appendix 7.

4.4.3 Outcomes

The cooperation between tertiary education and the business sector has achieved the following outcomes.

- The significant number of funding bodies in tertiary education enable R&D to be carried out at relatively high-risk levels.
- Companies and plants donate equipment.
- Cooperation between the business sector and tertiary education enables the existence of research that is aimed at to generating advanced technology products and processes at a high level of application.
- The cooperation allows the updating and upgrading of knowledge at universities and academic colleges on the one hand and the promotion of R&D at manufacturing plants on the other.
- The cooperation provides the business sector with opportunities to encounter a broad range of students and to identify high-quality human resources for recruitment into the commercial company.
- Socioeconomic mobility is promoted for outstanding individuals from the country’s periphery.

4.4.4 Challenges (NCRD, 2009; Ofek Eshkolot Ltd, 2010; Microsoft Israel, 2010; ORT Braude, 2010; Technion, 2010a)

Such cooperation presents a number of challenges.

- Cooperation with tertiary education is often problematic. It is difficult for industry, which functions according to strict schedules, to collaborate with organisations whose priorities are different. (In academia the priorities include research for publication purposes, teaching, sharing of knowledge, and issues surrounding confidentiality.)
- Disagreements can arise between the business sector and tertiary education on issues of intellectual property: Who does the research belong to: the industry, the faculty member, or the university? Universities are not willing to share copyright and creation, while the business sector takes ownership of the product.
- The applications companies are not always sufficiently astute to perceive changes in the environment in which they are functioning and then adapt themselves accordingly. The actual or potential gap in how the applications company and the university view situations is a key issue.
- There is a lack of awareness among managers in traditional industries of the importance of R&D processes in their work.
- There is a shortage of personnel willing to volunteer to mentor student projects in general, and among those who do volunteer, there is a shortage of people with appropriate mentoring skills.
- Attempts have been made to raise the level of knowledge within tertiary education, though it is difficult to arrange student and lecturer exchanges between institutions in Israel and abroad because of regulations and government bureaucracy, which make it hard to obtain work licences and an attractive salary.

- Most of the cooperation that currently takes place between tertiary education and the business sector is short term because it is difficult to make long-term budgetary commitments.

5. CONCLUSIONS

Over the past few years there has been a growing awareness of the need for cooperation between the education system and the business sector.

This report suggests that the aims of such cooperation, the benefits it bestows on each of the participants and the challenges they face are different and multi-layered, and depend on the different age groups of the students, and on the personalities of the leading educators in tertiary education on the one hand and in industry on the other.

Cooperation between primary schools and the business sector is intended primarily to expose pupils to the industrial experience and to encourage them to choose technological-professional tracks in secondary school. Most of the cooperation at this level of education takes place through Taasiyeda, in cooperation with the MoE and the MoITL. The activities in primary school require some financial outlay on the part of the schools, since they do not receive a dedicated budget for this purpose. As a result, many schools have trouble financing such activities. Moreover, there has not been sufficient evaluation to measure their effectiveness.

Cooperation between secondary schools and the business sector is undertaken in order to update the information available to school graduates regarding the demands and needs of technology-intense industry and to strengthen the connection between technology-track teachers and Israeli industry. This entails reciprocal learning between the business sector and the school system. It is also apparent that a great deal can be learned from examples of success in such cooperation from other countries, some of which have been applied in Israel.

Nevertheless, the report indicates that there are currently no government incentives to encourage industrialists and employers to develop cooperative arrangements with secondary schools. Most of this cooperation is based on the individual decision of the industrialist. Moreover, such activities are local and are not based on a long-term, ongoing organised process.

Cooperation between post-secondary institutions and the business sector is carried out for the purposes of:

- training to update the knowledge and professional skills of graduates and employees;
- developing Israel's human resources while linking them to the economic growth and activity of the market;
- increasing the employment rates of women, Arabs, ultra-orthodox Jews and individuals with disabilities.

The data also suggest that it is difficult to find businesses willing to take part in these activities. There is no coordination between the needs and demands of employers and what is available in the labour market, and thus the involvement of those firms that do take part is very limited. Government support for professional training among the more able populations has declined, and most of the existing support is specific, and relates to the ad hoc needs of certain locales at certain times.

Cooperation between tertiary education and the business sector is undertaken in two main areas:

- internships for students in industrial firms;
- promoting the R&D activities of the institutions concerned.

In general, student internships coordinated by industrial managers enable students to:

- gain experience in implementing large-scale development projects for an industrial enterprise;
- enrich both their own knowledge and that of the staff of the academic college or university;

- gain experience in searching for and finding a job;
- become aware of the needs of the economy.

These types of cooperation rely mainly on the personality of the community relations representative of the business and not on any unified policy. As a result, such cooperation is often local and short term.

The conclusion to be drawn from the reports and interviews used for this report are that the exchange of R&D knowledge between tertiary education and the business sector:

- enhances the image and marketing position of the university or academic college;
- improves the quality of teaching and learning;
- contributes to the advancement of the relevant professional skills of the faculty.

With regard to industry, there is a contribution to the development of creative ideas and a narrowing of the gap between basic and applied research, thus helping to ensure greater feasibility for groundbreaking development and innovation.

The universities and academic colleges establish applications companies to undertake R&D as specified by a business, or to sell the R&D of the tertiary education institutions to a business enterprise.

Government activities in this area are relatively extensive, and include encouraging entrepreneurs to innovate and providing new entrepreneurs with economic support through various government programmes. The support from businesses and the government for university R&D is limited in time, usually to between two and three years.

To date the majority of R&D in tertiary education has been undertaken by universities, but recently the government has also begun to encourage R&D in the academic colleges.

This report indicates that there are goals that cut across different age groups, including:

- responding to the needs of the economy;
- the exchange of knowledge between the business sector and the education system;
- developing awareness and desire on the part of pupils and students to integrate into the labour market;
- increasing the knowledge of pupils, students, teachers, staff members and head teachers;
- reducing the socioeconomic gaps in society.

Yet despite the advantages and benefits inherent in the cooperation between the education system and the business sector, no legislated, budgeted, comprehensive policy or supervisory or evaluation frameworks have yet been developed. This is the case for all levels of education. There is no single inter-ministerial body that functions as a consortium to give direction to this vital cooperation.

6. RECOMMENDATIONS

1. To create a legislated inter-ministerial body to institutionalise the various cooperation activities of all levels of education with the business sector (industry, commerce and services) and provide this body with a long-term budget. This body will be responsible for:
    - formulating a vision and goals, and developing standards and quantitative and qualitative indices to scrutinise cooperation between the education system and the business sector;

- identifying the characteristics of leaders, managers, teachers, pupils, schools, organisations and businesses that will enable predictions to be made regarding the success of cooperation between the education system and the business sector;
- developing benchmarks and a generic process for cooperation between the education system and the business sector;
- choosing/examining best practice examples of local initiatives and plans and turning them into a national plan;
- creating a model in which tertiary institutions accept people from industry as part-time staff, in a similar way to activities that take place in medicine and architecture.

2. To reduce governmental bureaucratic procedures, including by giving grants to students to fund their second degree, creating access for students and lecturers from overseas, and encouraging joint education–business research between Israel and other countries.
3. To ensure the efficient use of all the available resources, governmental and otherwise, and the rational utilisation of human resource potential in order to close gaps between supply and demand, and between the needs of the employers and trained workers, while increasing the productivity of the training system in terms of quantity, content, geographical coverage and time.

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List of tables and figures

APPENDIX 1: SOCIOCULTURAL CONTEXT – GENERAL DATA

Table 3: Primary and secondary schools under MoE supervision. No. of institutions, classes and students – selected years

	1948/49	1959/60	1969/70	1979/80	1989/90	1999/00	2007/08	2008/09
Primary								
Schools	512	1 640	1 738	1 787	1 722	2 281	2 499	2 509
Classes	4 031	13 087	17 431	21 009	22 757	28 893	32 742	33 514
Students	101 124	411 783	479 803	558 372	626 068	740 280	841 417	858 045
Secondary								
Schools	99	354	546	522	621	1 138	1 288	1 288
Classes	515	1 714	4 792	8 335	11 321	16 859	17 051	17 150
Students	10 232	55 156	37 358	216 616	325 706	467 305	462 854	460 923

Table 4: Secondary schools (grades 9–12) under MoITL supervision. No. of institutions, classes and students – selected years

	1999/00	2005/06	2006/07	2007/08
Schools	**80**	**71**	**71**	**67**
Classes	**827**	**728**	**718**	**690**
Students	**14 119**	**14 251**	**14 200**	**13 485**

Table 5: Number of students in post-secondary education under the supervision of the MoE (grades 13–14) and the MoITL (adults, post-army service) – selected years

	1970/71	1974/75	1978/80	1989/90	1994/95	1999/00	2004/05	2007/08
Students	15 517	26 227	27 351	25 307	42 548	55 596	57 849	60 299

Table 6: Degree recipients by faculty of study and by degree, 2007/08

	Diploma	PhD	Master's	Bachelor's	Total
Total	**851**	**1 427**	**11 759**	**18 793**	**32 830**
Humanities	769	353	2 367	3 580	7 069
Social sciences	43	228	4 644	6 671	11 586
Law	-	14	1 236	867	2 117
Medicine	-	91	1 123	2 155	3 369
Natural sciences and mathematics	27	581	1 438	2 799	4 845
Agriculture	-	25	156	258	439
Engineering and architecture	12	135	795	2 463	3 405

Table 7: Degree recipients from universities, the Open University, academic colleges and academic teacher education colleges, by degree and population group

	2004/05	2006/07	2007/08**				
			Total	Universities	Open University	Academic colleges	Teacher education colleges
Bachelor's							
Number	**36 454**	**39 261**	**39 349**	**18 793**	**2 259**	**12 830**	**5 467**
%	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Women (%)	60.2	59.6	58.9	57.6	58.9	50.1	83.9
Master's							
Number	**11 610**	**13 351**	**13 649**	**11 759**	**331**	**1 300**	**259**
%	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Women (%)	56.8	56.2	57.1	56.5	49.7	59.4	84.8
PhD							
Number	**1 206**	**1 288**	**1 427**	**1 427**	**-**	**-**	**-**
%	**100.0**	**100.0**	**100.0**	**100.0**	**-**	**-**	**-**
Women (%)	52.0	53.0	52.1	52.1	-	-	-

** In 2007/08 Israel had 7 universities, 28 academic colleges and 27 academic teacher education colleges.

APPENDIX 2: SOCIOECONOMIC CONTEXT – GENERAL DATA

Table 8: Workforce – Population aged 15+ by type of living settlement and gender, 2008

Settlement type, gender	Population aged 15+	Civilian workforce	Total
	Thousands		Civilian workforce as a percentage of population aged 15+
Total	**5,232.9**	**2,957.1**	**56.5**
Urban settlements	4,809.0	2,695.0	56.0
Rural settlements	423.9	262.1	61.8
Moshavim	180.2	118.2	65.6
Kibbutzim	95.1	71.7	75.4
Other rural communities	148.6	72.2	48.6
Men – total	**2,549.4**	**1,579.9**	**62.0**
Women – total	**2,683.5**	**1,377.2**	**51.3**

Figure 1: Total number of employed by branch of the economy, 2008

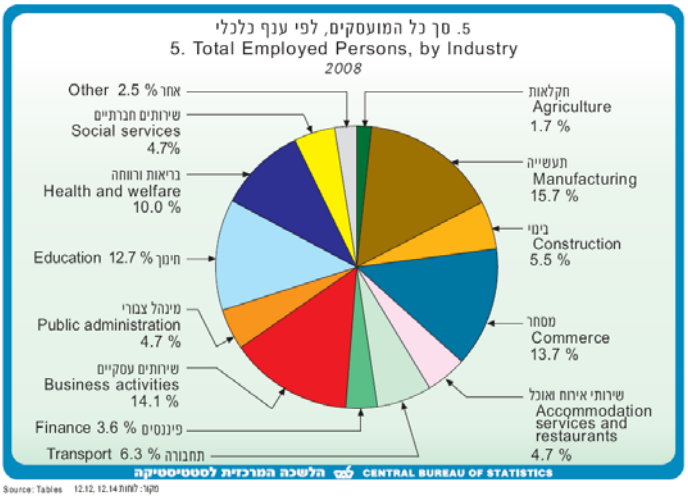
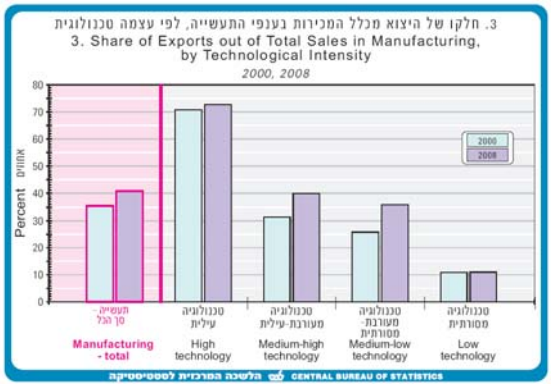


Figure 2: The proportion of exports out of the total sales in manufacturing by technological intensity, 2000 and 2008



APPENDIX 3 THE ORT ISRAEL NETWORK

Founded in 1949, ORT Israel is an apolitical, non-profit NGO. It is the foremost, and largest, technology education network in Israel, and is dedicated to instilling values in its students and providing a broad education that focuses on science and technology. Its institutions include six-year comprehensive secondary schools, industrial schools, education centres, colleges of practical engineering and academic colleges for Bachelor's and Master's degrees in engineering. The network is responsible for some 93 000 students (one secondary student in every ten in Israel is an ORT student) in 184 institutions in 70 locations around the country, from Shlomi and Hatzor in the north down to Yerucham and Abu Basma in the south, in particular in the geographical and socioeconomic periphery of the country. This spread of schools covers all sectors of Israeli society: secular and religious Jews, Muslim and Christian Arabs, Druze and Bedouin.

ORT Israel's colleges of technology are located in 30 different sites across the country and train some 30% of the country's technicians and practical engineers. Graduates of the colleges of technology (including the ORT Braude and ORT Hermelin Academic Colleges of Engineering) are employed in the technological units of the IDF and in many of the country's top public and private enterprises.

Some of the network's main goals relating to this report are as follows:

- cultivating science, technology and IT education among its male and female students and preparing graduates for success in universities and technical colleges, in the IDF and in advanced industry, as well as in other branches of the economy, helping them to realise their potential, talents and preferences in order to promote their socioeconomic mobility;
- encouraging ties with industry and the IDF in order to promote valuable technological cooperation and to open up recruitment opportunities for its students according to their talents and vocational/professional training;
- initiating, developing and implementing a wide range of study tracks and technology-oriented curricula for ORT Israel in particular, and the entire Israeli education system in general, in collaboration with industry, tertiary education and the IDF.

APPENDIX 4: THE AMAL NETWORK

The AMAL network has 39 multi-disciplinary schools, from Dimona in the south up to Safed and Nahariya in the north. These schools are under the supervision of the MoE and offer comprehensive as well as technological/vocational education to all sectors of the population – secular Jews, Muslim Arabs and Druze. The students choose the vocational study tracks in which they wish to specialize from the full range of 18 offered by the MoE's Science and Technology Administration (AMAL network, 2010a).

The students in this network are guided towards matriculation to make them eligible for academic studies and technician and practical engineering studies, as well as integration into the IDF and the workforce.

In addition, the AMAL network has ten Centres of Technological Education supervised by the MoE that are intended for lower-achieving students, who receive vocational training and study basic core subjects. These students are in contact with industrial firms in the vicinity of the school, and here they are introduced to the world of industry.

The connection between these multi-disciplinary schools and the industrial plants follows a network policy conveyed from the headquarters to the schools, but at the same time schools are encouraged to initiate their own appropriate cooperation.

The AMAL network is a member of the Education Committee of the MAI alongside the ORT network, and together the cooperation is led jointly by MAI and the technology education networks.

In addition, the AMAL network has 20 industrial schools around the country which combine studies with practical work at local plants, for which the students are paid, from grade 11 onwards. Students must pass examinations in certain subjects and complete the practical work (AMAL network, 2010b).

The AMAL network, together with the MoITL, recently decided to provide vocational training for the ultra-orthodox Jewish sector (a two-year course for grades 11–12) mainly for young people at risk (some 700 girls and boys).

APPENDIX 5: COOPERATION BETWEEN SECONDARY EDUCATION AND THE BUSINESS SECTOR

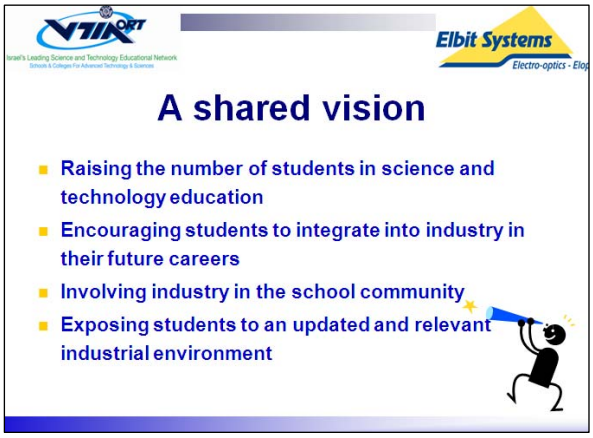
El-Op Ltd. adopts ORT Afridar, Ashkelon (El-Op Ltd, 2009; ORT Afridar, 2009): This is a unique initiative between the ORT Afridar school in Ashkelon and Elbit Systems – Electro-Optics (El-Op) Ltd. The purpose of the cooperation is to expose students in the Tech-Mat programme to all aspects of industry, and to emphasise the importance and feasibility of their integration into it. El-Op works to expand the general knowledge of both students and teachers; it encourages excellence and exposes these students to Israel's hi-tech world.

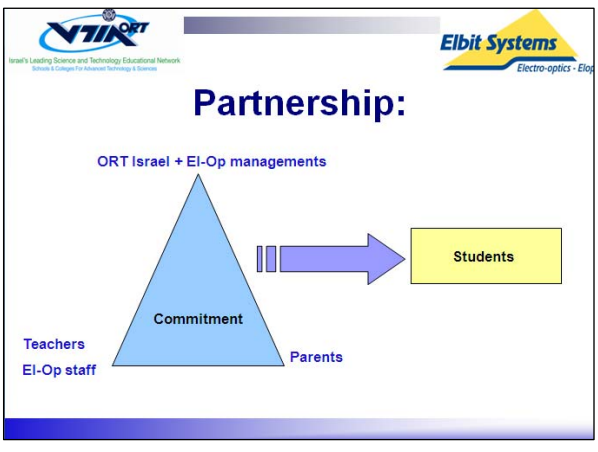
The cooperation activity is conducted under the auspices of the MAI and ORT Israel.

This adoption programme includes many knowledge-enrichment activities, such as field trips to the El-Op premises, lectures to students and teachers, professional enrichment classes given by El-Op engineers at the school on various subjects, workshops to construct a telescope, El-Op participation in the school's ceremonies and activities, awarding of scholarships to outstanding students by El-Op's managing director, and continuing education at El-Op for mechanics teachers.

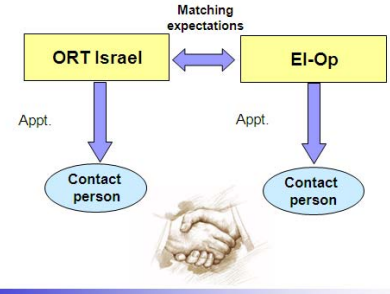
This productive cooperation was epitomised by the 'El-Op Day' that was held at the school under the slogan 'ORT Afridar and El-Op march together towards the industry of tomorrow'. The day included workshops and many activities under the direction of senior El-Op personnel and students involved in the Tech-Mat programme, who enabled all the students to gain a glimpse of the wide range of activities at El-Op. The students went on a 'treasure hunt' at the school, using instruments and exhibits brought from the company for this purpose. Specialised instruments and exhibits manufactured by the company were on display around the school, each accompanied by an explanation given by El-Op instructors about its operating principles and possible applications.

This activity was presented at the EU Conference in Brussels on Education–Industry Cooperation in December 2009, and received very positive feedback.





Operations:



Activities:

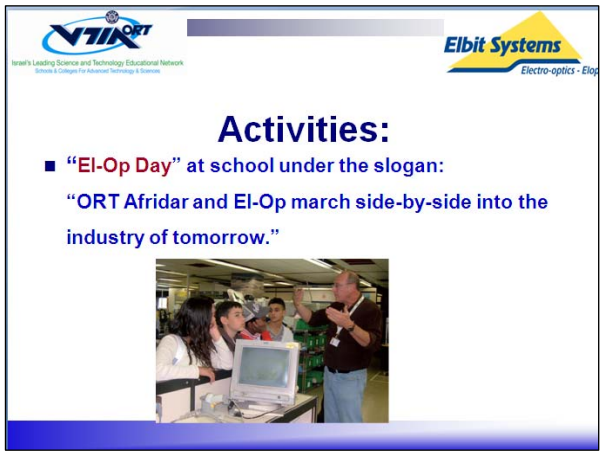
- Field trips to the company with visits to optics, mechanics and assembly plants and presentation of their equipment.
- Lectures to students, teachers and parents, on topics such as electro-optics and satellites.

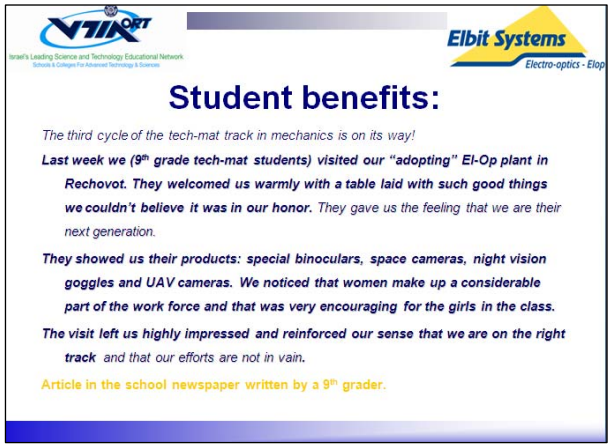
Activities:

- Enrichment classes given at school by El-Op engineers on topics such as optic production and electronic systems production
- Telescope building workshop.

Activities:

- Professional training and professional development for teachers.
- El-Op participation in school ceremonies and activities
- Awarding scholarships to outstanding students.
- Participation of school management and teachers in the El-Op Entrepreneurship Prize ceremony.





Cooperation between head teachers and managers in the business sector:

'Meeting point' (ORT Israel, 2010a): This is a project initiated by ORT Israel to connect business corporations in various sectors and public figures around the country with ORT Israel schools. The model was constructed according to the PENCIL programme established by Dr Lisa Belzberg, which has been operating in the United States with great success since 1995. The objective of 'Meeting point' is to facilitate ties between business leadership and school management teams in Israel that will inspire innovation in education and contribute to the advancement of students. Such meetings lead to a combination of creative ideas and management skills from the business world within the education system. The project starts with one day of meetings between the business manager and the school/college management team.

The 'Meeting point' project was launched during the 2008–09 school year with 17 senior managing directors from the world of business and industry. In 2009–10 this project was expanded to 35 managing directors and 35 head teachers.

Partners: Business corporations, ORT Israel schools.

The initial day of meetings emphasised the importance of technology education in general and the Tech-Mat programme in particular, for all students and teachers at the school.

The 'Managers adopting heads' project (Ministry of Education, 2010; Taasiyeda, 2010): This project is intended to create cooperation between head teachers and managers in the business sector. Its objective is to create a productive dialogue, mutual recognition and proximity at the personal and professional level between head teachers in the education system and managers in the business sector that recognises the needs of both organisations; and to create cooperation.

The programme was launched during the 2007–08 school year with 36 managers. So far, 200 pairs have participated in the programme (200 from industry and 200 from the education system) in all sectors and throughout the country.

Partners: The MoE, Taasiyeda.

Cooperation with international industries:

The Net@ Cisco project (Net@, 2010): This project was established in 2003 as a unique community social venture by the Tapuach non-profit NGO, the Jewish Agency, the JNF (Jewish National Fund) and the Cisco Systems Corporation. Its purpose is to create a change in the course of the lives of young people aged 14–18 in the geographic and social periphery of the country, turning them into the 'dream team' of Israeli hi-tech industry.

Net@ combines the training of these young people in the computer and communications professions and giving them practical experience in leading hi-tech companies, with instilling social values such as excellence, individual and group responsibility, leadership, pluralism, multi-culturalism, democracy, and contribution and commitment to the community.

Net@'s technological studies programme is spread over three years, as follows:

Year 1: computer technicians' course and the first semester of a network technicians' course;

Year 2: second semester of a network technicians' course;

Year 3: leadership and practical training.

The programme was launched in 8 towns in 2003, and in 2007 it ran in 25 towns and 70 educational institutions. Net@ started with 380 students, and by 2007 some 1 600 students were participating.

IBM: Encouraging science and technology among ORT Israel students (ORT Israel, 2010a).

The E.X.I.T.E. summer school is held at the IBM Research Lab in Haifa, and is part of IBM's global programme. The purpose of this programme is to encourage female students in their teens to study technological subjects to enable them to integrate into these fields in the future.

The programme is now in its third year in Israel, and involves the exclusive cooperation of the ORT Israel network, with 24 outstanding students being selected from several of the ORT schools from the northern region from the Jewish, Arab and Druze sectors. The girls are hosted by the IBM Research Lab in Haifa for days of intensive activities, during the course of which they are exposed to the hi-tech world through specially designed workshops and lectures from scientists and engineers from the IBM Research Lab. The girls from the ORT Israel network become involved in, among other things, programming using 3-D software, the development of applications in the Second Life environment, constructing robots in team projects and participating in mathematical challenge quizzes.

Partners: IBM and ORT Israel.

The 'Integrating students into industry' programme (Ministry of Education, 2010): This is a new MoE initiative. The programme is due to commence during the 2010–11 school year in 17 schools with around 425 students.

The purpose of the programme is to prepare a cadre of skilled people and to reinforce the connection between technological-vocational education and industry. During their studies the students will be accepted for work within industry even before they find work as certified vocational graduates. The students will gain practical experience both at technological centres and in industry. The practical experience will be supervised by instructors from the industries themselves. The programme is funded by the MoE.

Partners: The MoE, the MAI, the National Insurance Institute, the non-profit NGO 'Jump start to the future' and the technology education networks.

Adapting subjects and curricula to meet the needs of the economy (Ministry of Education, 2010; Department for Technology Education and Vocational Training, 2010): This is a new initiative from the IDF, the MAI and the MoE. Five committees will be established to examine the content of and subjects in the various tracks: mechanics, electrical engineering, electronics, computers and industrial design. These committees will define and validate (and consolidate) the subjects and curricula and adapt them to the needs and relevance of the national economy.

Each committee will include professionals from the MoE, the IDF and industry. These committees will commence activities during the 2010–11 school year.

The 'Encouraging girls into industry' project (Ministry of Education, 2010; Taasiyeda, 2010): This is a new project from the MoE and Taasiyeda, which is aimed at girls from both the Jewish and Arab

sectors. Its objectives are to expose the girls to various aspects of industry, to increase the proportion of girls becoming involved in industry as a career, and to reinforce coexistence between Jewish and Arab students. The project was launched in the 2009–10 school year and will continue for three years, during which time 120 students (10th–12th grades), will participate from the industrial engineering and management and business administration tracks.

This program is being funded by the MoE.

Participants: The MoE, Taasiyeda

'Learning on the job' (AMAL network, 2010b): This is a joint venture between the AMAL network and a factory in the town of Afula. Students study for three days a week at the factory itself, using the factory's equipment, and are introduced to up-to-date technological advances. The instruction is delivered jointly by teachers and instructors from the factory.

This is a successful local initiative that should be expanded to other locations.

Partners: The AMAL network, industry.

FIRST (For Inspiration and Recognition of Science and Technology) (Department for Technology Education and Vocational Training, 2010): This programme is intended to instil motivation towards technological and science studies (at the post-secondary level) through a competition in the field of robotics. This organisation was established in 1994 in the USA as a response to the lack of motivation on the part of young people there to study advanced technological subjects; the programme was launched in Israel in 2005.

Students construct a robot and various applications according to the global game rules. In the robotics competition for 2008 in Israel, around 50 primary schools and 40 secondary schools participated.

Industry is involved both in financing the development kits and in professionals assisting students to develop the robot.

Israel Electric Corporation (Israel Electric Corporation, 2010): Activities promote studies in electronics, electrical engineering and the environment and nurture 'green thinking'. These educational activities are directed towards primary and secondary schools. Courses and workshops are held on the subjects of electricity, energy, technology, science and the quality of the environment, with lecturers from Electric Corporation specialists and professionals from industry.

In addition, the Electric Corporation holds workshops on the recycling of waste materials (cables, wires and insulators), which can be used creatively to make art and design pieces.

Partners: The Electric Corporation, schools, local authorities and councils, the technology education networks.

APPENDIX 6: COOPERATION BETWEEN POST-SECONDARY EDUCATION AND THE BUSINESS SECTOR

On-the-job training:

Providing Israelis with on-the-job training in industrial and service sectors and in the building industry (Ministry of Industry, Trade and Labor, 2010a, 2010c): The purpose of these programmes is to integrate unemployed people into the workforce, to reduce the level of unemployment and to offer basic vocational skills through on-the-job training at a factory or building site.

The employer hires new workers as ordinary employees for a full-time job earning at least the minimum wage. The MoITL contributes a payment of ILS 1 000 per month per employee for a period of up to 6 months.

During the training the employer will allocate a professional instructor from the factory or building site who will supervise and instruct the new worker.

With regard to the training of employees, employers will be entitled to a sum of ILS 3 000 per month for a group of 3–10 trainee employees who will be sent to sit the examinations for vocational certification. The employer will continue to employ them after the end of the training period for a cumulative period of at least 12 months.

This programme is financed by the MoITL and the participating enterprises.

Partners: The MoITL, industrial companies and enterprises.

The training of workers for the hotel industry (Ministry of Industry, Trade and Labor, 2010a): This is an initiative of the MoITL and the Hotels Association. It is intended for adults and young people, both male and female. The objective of the programme is to form a cadre of personnel for hotel industry professions. The study programmes are adapted for the hotel professions, and the Department for Professional Training assists in the selection of candidates for this course of study. Following this cooperation, the Department for Professional Training of the MoITL is kept informed with data on new professions. This programme allows students to gain practical experience in workplaces, while at the end of their studies, the programme leaders assist the graduates to find employment. This initiative has been running for some three decades and is financed by the government.

Revising and adapting the study tracks and skills for technicians and practical engineers (grades 13–14) for the purposes of industry and the IDF (Ministry of Education, 2010): This is a new initiative of the MoE, the IDF and the MAI. During the 2010–11 school year, a committee will be set up to examine the study content of and subjects in the studies for technicians and practical engineers. The committee will define and formulate subjects and content and will adapt these to the needs of the market. Furthermore, the committee will assess how it is possible to provide students with skills and aptitudes independent of content, such as: the ability to study independently, team work, entrepreneurship, creativity and original thinking, English as the language at work, the ability to make decisions under conditions of uncertainty, planning targets and meeting schedules.

Each committee will include participants who are professionals from the MoE, the IDF and industry.

‘A classroom at the plant’ (Ministry of Industry, Trade and Labor, 2010a, 2010c): The MoITL, through the SDVTHR, runs a unique training course, ‘A classroom at the plant’, the objective of which is to increase the opportunities for designated training for those looking for employment. The target population are unemployed people who are looking for work, with priority being given to the ultra-orthodox Jews, Arabs, people with disabilities, single parents, immigrants who have been in Israel for up to 10 years, and those over the age of 45.

This programme trains workers that are demand in industry. Workers such as: printing, energy and water systems, metals/machines, electrical engineering and electronics, and fashion and textiles.

The enterprise undertakes to provide full-time employment of at least a year for course graduates within two months of the date of completing the course.

The MoITL gives enterprises a bonus for every employee accepted for employment.

This programme is funded by the MoITL and industrial enterprises.

Partners: The MoITL and industrial enterprises.

‘From Poverty to Indepdence’(Ministry of Industry, Trade and Labor, 2010c): This programme is intended for those with physical, sensory or emotional disabilities, and aims to provide quality placement through vocational training.

The programme identifies employers requiring workers in a range of fields, and includes a vocational course constructed in collaboration with the potential employers. Studies combine accessible theoretical studies and practical experience in the workplace from the initial stages of the course. At the end of the course, and after participants have passed the final examinations, places of employment are found for them.

The uniqueness of this programme lies in the fact that training programmes are developed in training centres, factories and businesses.

The programme was launched in 2006, and has delivered 12 courses involving 230 participants in the following fields: wiring and soldering, the art of cooking, geriatric care, vehicle mechanics, service representatives and reception clerks.

Partners: JDC-Israel, the Ministry of Health, the National Insurance Institute’s Rehabilitation Department, the MoITL’s Professional Training Department, Ashnav Ltd.

APPENDIX 7: COOPERATION BETWEEN TERTIARY EDUCATION AND THE BUSINESS SECTOR

Government support frameworks of the Chief Scientist's Office of the MoITL:

The MAGNET[13] programme (MAGNET, 2010; ORT Braude, 2010; Technion, 2010a): This is one of the support frameworks of the Chief Scientist's Office of the MoITL. Its goals are as described in the following passage:

> …to strengthen and expand the technology infrastructure of Israeli industry, both by local development of pre-competitive generic technologies and by circulation and assimilation of generic technologies developed in Israel and overseas.

Technological development is based on cooperation between a number of manufacturing companies and research institutions, which join together as a consortium. Cooperation consists of establishing joint working groups, information centres and websites. Its legal format is set out in the corporation regulations of the members of the consortium. The cooperation is a means to achieve the goals of the program through mutual contribution and saving on resources.

The MAGNET programme began in 1994. The manufacturing company receives up to 66% and the research institution up to 80% of the cost of the project as a grant.

The Director of MAGNET felt it necessary to conduct an evaluation survey from which the following emerged (MAGNET, 2002).

The contribution to industry of the MAGNET programme lay mainly in the building of a technology infrastructure on which various products could be developed. Building this infrastructure was defined in the questionnaire as 'gathering and developing knowledge' and was ranked as the most important issue for a company in the MAGNET programme. Most companies indicated that the MAGNET programme had made a positive contribution to their company. Only very few said that the cost to the company was greater than the benefit of their participation in the project. For the majority of the companies, the programme was ranked 'positive' or 'very positive'. Its contribution was expressed in many cases in the acceleration of R&D processes in their core business.

The results clearly demonstrate the role of MAGNET in the technological advancement of companies on the one hand, and the willingness to absorb technology on the other. All those interviewed mentioned that cooperation in the consortia was welcome. It allowed them, among other things, to meet other people working in their field, learn how to work together, overcome suspicions, and learn to consult with experts as required.

It emerged that most of the cooperation was conducted between two companies; there was no multi-organisational cooperation. It also emerged that the issue of ownership of intellectual property was problematic and interfered with full cooperation.

There is a need for a comprehensive study to be undertaken in order to examine the benefits of cooperation between tertiary education and the business sector in various areas such as R&D, internships in industry and project mentoring.

The NOFAR project (Ministry of Industry, Trade and Labor, 2010c; ORT Braude, 2010; Technion, 2010a): The MoITL helps to strengthen and expand the technological basis of Israeli industry through a legislated research foundation for the encouragement of R&D in industry. The purpose of the NOFAR programme is to increase the applications potential of academic research studies by providing opportunities in and guidance towards industrial fields that have economic potential. The goal of the programme is to promote applied research conducted at academic research institutions in Israel specifically in the fields of biotechnology and nanotechnology – two fields at the forefront of world technology knowledge.

[13] MAGNET – Hebrew acronym for Generic Technology R&D.

Cooperation in order to help young adults acquire high-level tertiary education and integrate into industries and businesses in Israel

High-tech Horizons (Ofakim) – engineers from the periphery (Manufacturers' Association of Israel, 2010; Technion, 2010a, 2010b; Ben Gurion University, 2010; Ofakim for Hi-tech, 2010): This is a programme designed to offer equal opportunities to discharged soldiers from the periphery to acquire academic education in science and technology. It was initiated by the president of the Rad Binat Group and the Chairperson of the Israel Association of Electronics and Software Industries (IAESI). Students receive full funding for their tuition, including a preparatory course, and living expenses during their studies, and in return they are obliged to engage in personal tutoring or other educational social activity. Funding for the programme is based on government sources, foundations, and donations from the business sector. The purpose of the programme is to create a cadre of qualified personnel from the periphery and thereby strengthen these areas and bridge the gaps between the periphery and the centre of the country.

The programme began in 2008, and currently has 60 students at Ben Gurion University of the Negev in Beer Sheva and around 70 students at the Technion in Haifa.

The mission of this programme is to reach some 1 500 students each year, and thus give every discharged soldier an opportunity to realise his or her potential.

Partners to the program: Rad Binat, IAESI, Ministry of Defence – Unit for the Guidance of Discharged Soldiers, the Rashi Foundation, the Gross Foundation, the MoE, Ben Gurion University, Tel Aviv University and the Technion.

ATIDIM for industry and business (ATIDIM, 2010): This programme is designed to identify young adults (aged 21–30) from the social and geographical periphery in Israel and help them to acquire high-level tertiary education and integrate into industries and businesses in Israel. The programme gives opportunities to young people whose academic standards make them eligible for university or academic college, but who can not afford to attend. It helps these students to complete their undergraduate studies in a field that is required by the business sector, while giving them exposure to on-the-job experience. The students' tuition fees are covered and they receive a monthly grant to cover their living expenses. Their on-the-job experience throughout their studies is one day a week, with the option of continuing to work in the adoptive company for three years after completion of their studies. This year (2009-2010) there were 500 students in the project, mainly studying engineering. The programme began in 2002 and already has 348 graduates, most of whom are now working in manufacturing and hi-tech industries. Out of 500 students in the project, 71 are of Ethiopian origin, 73 are from former Soviet states and 31% of them are women.

Partners: the MoITL, the MAI, the Unit for Guidance of Discharged Soldiers, the Gross Foundation, the Hesegim (achievements) programme, the Israeli Society for Quality (ISQ), the Israeli Purchasing and Logistics Managers Association (IPLMA), tertiary education institutions and some 140 adopting companies and bodies.

Student internships in commercial companies

Microsoft (Microsoft Israel, 2010): One of the Microsoft's many activities in Israel concerns outstanding students. Microsoft awards scholarships to such students (20 scholarships per cycle, three cycles per year) as well as assistance and mentoring for their final project. The goal of the programme is to improve scholastic quality so as to bring about a higher level of professionalism among the faculty staff. The students are not obliged to work at Microsoft on completion of their studies, but the programme enables Microsoft to reach the best people and create the image that it the company is a worthwhile place to work. The intensive support and counselling of the students for their projects is carried out by company employees on a voluntary basis.

ORT Braude College of Engineering: The purpose of the programme is to promote and develop the level of up-to-date, relevant teaching and learning at the ORT Braude Academic College. Between the third and fourth year of study, a student begins a five-month-long internship involving between 700 and 1 000 hours of on-the-job experience at a commercial company.

For the first time, a student gains experience of a large-scale development project at an industrial enterprise. Guidance is provided both by a mentor from the company and by one of the college faculty members. The responsibility for finding a company for the internship lies with the student, who thus gains experience in the process of seeking and finding a job. In most cases the students receive payment for their work, but if they do not, the college and the Galilee Development Authority provide them with scholarships.

The internship is mandatory for students studying biotechnology, electronics and mechanics, but is not mandatory for students studying industrial management.

This programme enables students to ease into the workforce and allows the companies and the students to test their compatibility during the five months of the internship.

Technion's examples of cooperative ventures with the business sector

Professor Golani (Technion, 2010a) states that the Technion's Faculty for Industrial Engineering and Management conducts many cooperative ventures with the business sector, including the following.

An Industrial Advisory Council has been established. It comprises 16 senior industrialists such as the CEOs of Microsoft and IBM and the president of Phoenicia America Israel Flat Glass Ltd. The council meets quarterly and its roles are to provide feedback on questions regarding development programmes (what is important, what should be given greater attention), to lobby the government and the Council for Higher Education, and to pave the way for cooperation between the Technion and business and manufacturing companies.

A finance and investment club has been set up; this is a student club that is based on the model at Pittsburgh University in the USA. It is sponsored by financial bodies such as banks and e-commerce companies. Its main activity is enriching students' knowledge of financial matters through lectures by key figures and experts from the business sector.

A range of activities are undertaken with international companies such as IBM, Proctor & Gamble, Intel, Google, Hewlett Packard and Yahoo. These activities revolve mainly around the students' research topics and final projects. The aims of these activities are to familiarise students and faculty members with up-to-date and relevant problems, to open up students' employment horizons, to retain high quality personnel in the faculty and to preserve the status of the Technion.