British Embassy & British Council in Tel Aviv

Supporting UK - Israel activities from Science to Trade

July 2022

pwc

In association with

UK Government

BRITISH COUNCIL

Foreword

The British Embassy in Tel Aviv and the British Council asked PwC to independently assess the impact of their work in recent years to support UK-Israel relations. Specifically, PwC were asked to look at how programs to support Trade, Investment, Innovation, Science & Academic partnerships between Israel and the UK have contributed to economic activity in the UK.

This report, which highlights the benefits of UK-Israel Trade, Investment, Innovation and Scientific relations over the last decade, is the first known study to quantify the economic contribution of Israeli Foreign Direct Investment (FDI) in the UK economy. Through quantifying the impact of Israeli FDI on UK economic output and employment, we've built a picture of the immense value of this trade relationship, and the critical role the British Embassy in Tel Aviv plays in supporting and facilitating this investment. The beginning of negotiations for a new Free Trade Agreement, planned for later in 2022, will be a further significant opportunity to widen the depth and value of the UK's trading relationship with Israel.

The British Embassy in Tel Aviv has helped attract **£1.2bn** of Israeli FDI into the UK from 2014-2021. PwC modelling reveals this has supported an estimated **15,370 jobs** and over **£1bn of economic activity** across the UK over the same period. This FDI has been undertaken across a range of priority sectors for the UK economy such as Information & Communication (including cybersecurity, fintech and health tech), Manufacturing (including advanced innovation) and Transportation & Storage.

Additionally, academic and scientific partnerships have become a cornerstone of international collaboration between the UK and Israel. This report finds that funding for Israeli early career researchers to come to UK universities generates economic contributions in the UK of **1.53x** the value of grants provided to them through programmes delivered via the British Embassy and British Council. Further, outcomes from joint UK-Israel medical research have the potential to generate net direct economic benefits of approximately **4.7x** the value of the research funding in a single year alone, and up to **18.3x** in the first four years.

We trust you will enjoy exploring the findings in this report, and thank the case study partners Optibus, REE Automotive, Helios Energy Investments, NatWest Group and academics at Queen's University Belfast, Tel Aviv University, The University of Cambridge and Technion Israel Institute of Technology for their support with this important study.

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£1.2bn of Foreign Direct Investment (FDI) | **c.£400m** in capital investment

The British Embassy Tel Aviv (BETA) has helped attract **£1.2bn** of Foreign Direct Investment (FDI) across 204 projects undertaken by 167 Israeli firms from 2014 to 2021. Additionally, the Embassy supported Israeli firms to undertake c.£400m of capital investment from 2015 to 2020.

Key business support programmes provided by the Embassy include:
- coordinating bilateral investor & customer visits (both to Israel and to the UK);
- providing strategic advice on locations to establish business activities and opportunities available in line with UK Government priorities; and
- helping Israeli companies navigate UK regulatory and legal requirements and understand funding potentially available.

These activities have helped attract significant Israeli investment in the UK from transport management platform Optibus, EV platform & chassis manufacturer REE Automotive and infrastructure investment firm Helios Energy Investments.

£1bn+ of gross value added (GVA) economic impact | **16,000** total jobs

From 2014 to 2021, Israeli FDI generated more than **£1bn of gross value added (GVA) economic impact**, and supported c.6,000 direct jobs in the UK (and a further c.10,000 indirect and induced jobs).

10,000 indirect and induced jobs in the UK | **£600m** in GVA

Key sectors for Israeli FDI into the UK include Information & Communication (including fintech and healthtech), Manufacturing (including advanced manufacturing) and Transportation and Storage.

There are spillovers from Israeli firms undertaking FDI into the UK through induced and indirect impacts and spending in all UK sectors, equivalent to £600m in GVA and c.10,000 jobs from 2014-2021.

£16m funding for scientific research

Concurrently, the Embassy and the British Council have provided, thanks to the support of their partners and stakeholders, £16m of funding for science and academic partnerships and activities between UK and Israel researchers from 2012-2021. The multiplier effect in terms of benefits to the UK economy of funding these activities is an estimated **1.53x** for grants provided to Israeli early career researchers to study in the UK, and an estimated **4.7x** for joint UK-Israel medical research partnerships.

In recent years, the role and impact of the British Embassy Tel Aviv (BETA) has expanded significantly, and it is now home to a number of UK Government bodies working across trade, investment, innovation, science and academia to support and foster UK-Israel economic, scientific and technologic relations.

The UK is the number one destination for inward investment in Europe,[1] and a key outcome of the Embassy's work in recent years to connect UK and Israeli businesses has been attracting Foreign Direct Investment (FDI) to the UK from Israeli sources.[2] The Embassy, via the UK Israel Tech Hub (UKITH) and Department for International Trade (DIT) has supported more than 150 Israeli firms to invest in the UK since 2014, and has helped UK businesses access Israeli tech and other business solutions. Additionally, the British Council (BC) and the Embassy via the Science and Innovation Network (SIN) has provided approximately £16m[3] of funding from 2012-2021 to support joint UK-Israel research partnerships. Alongside the economic benefits, this funding has generated benefits for the scientific community including by promoting research in areas that have not typically attracted commercial funding, helping get projects off the ground so they can access further funding once established and helping build connections between scientists and researchers that otherwise may not have collaborated due to their specific fields of research.

Key support provided in recent years includes:

UK-Israel Tech Hub[4]
- Coordinating bilateral investor & customer visits (both to Israel and to the UK)
- Facilitating potential investor & customer introductions
- Providing on the ground support in Israel for UK companies working with Israeli tech

Department for International Trade
- Advising on strategic investment opportunities in line with UK Government priorities
- Practical advice on locations / regions to establish business activities in the UK
- Helping Israeli companies navigate UK regulatory and legal requirements

Science and Innovation Network
- Working with scientific and academic communities to identify potential areas of collaboration between UK and Israeli researchers
- Facilitating knowledge transfer through exchange programmes, networking and access to international facilities
- Scientific diplomacy and informing research policy

British Council
- Building, connecting and maintaining the UK-Israeli academic, science and research communities
- Developing and operating donor-funded joint UK-IL research and mobility programmes

The support provided by the Embassy has helped attract and incentivise Israeli firms to invest in the UK. From 2014-2021, a total of £1.2bn Israeli FDI was invested in the UK. This is made up predominantly of capital expenditure (capex) and operational expenditure (opex) of Israeli firms setting up operations in the UK. Examples of Israeli firms that have undertaken substantial investments in the UK as a result of the Embassy's support include:

£10m+

Transport management platform **Optibus** launched its AI optimisation software in the UK in 2018. The company has invested tens of millions of pounds in the UK since 2018, including establishing its EMEA HQ in London.

£68.9m

Automotive technology company and EV chassis manufacturer **REE Automotive** committed £68.9m to establish an 'Engineering Centre of Excellence' in the UK from 2021-24, including an engineering centre in Nuneaton and an integration centre in Coventry.

£205m

Infrastructure investment firm **Helios Energy Investments** invested £205m in the UK from 2014-2020. Their investments were focused initially on solar renewable energy projects, and more recently in waste-to-energy facilities.

1 UK Trade and Investment (UKTI), The UK: The Number 1 Destination for Inward Investment (FDI) in Europe, https://www.youtube.com/watch?v=R0UT6TGstEI

2 FDI is the direct or indirect ownership of 10% or more of the voting power of an enterprise resident in one economy by an investor resident in another economy. See Appendix D for further information on FDI.

3 Funding has been provided to the Britain-Israel Research and Academic Exchange partnership (BIRAX), Blavatnik Cambridge Fellowships, SYNERGY Research Mobility and Wohl Clean Growth Alliance projects.

4 The UK-Israel Tech Hub is part of DCMS' International Tech Hub Network (ITHN) of global tech hubs to drive innovation partnerships between the UK and international tech sectors, stimulate local digital economies, build high end digital skills and support sustainable jobs and growth. Other Tech Hubs are located in Indonesia, Kenya, Nigeria, Brazil and South Africa. Further detail is provided in Appendix B.

In parallel, the Embassy (and particularly the UKITH) has supported UK businesses in accessing the best that Israeli tech and innovation has to offer in terms of business solutions.

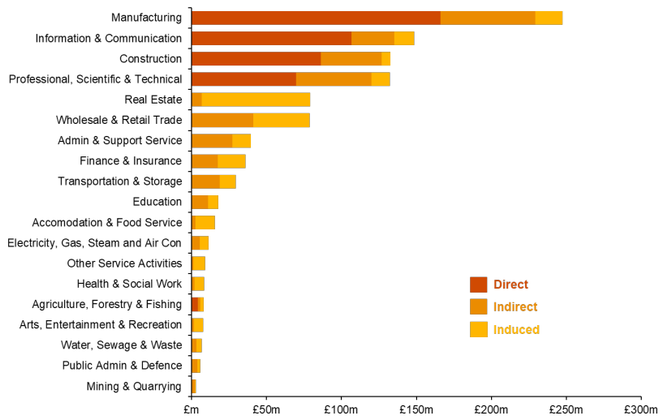
The impact of the £1.2bn of investment made by Israeli firms from 2014-2021 is over £1bn[5] of gross value added (GVA) economic impact in the UK, and 15,368 direct, indirect and induced[6] jobs.

Figure 1 below illustrates the total GVA impact of Israeli investment from 2014-2021 by sector, and Figure 2 shows the direct, indirect and induced jobs supported by Israeli investment.

NatWest Group

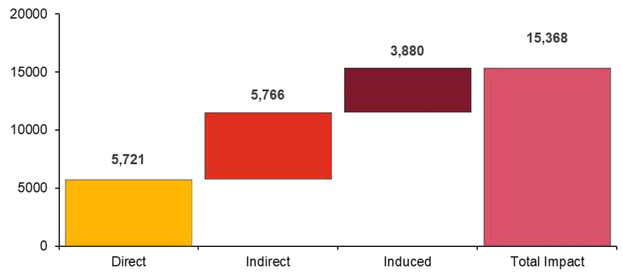
NatWest Group has worked with the UKITH since 2015 to build connections with Israeli innovators and tech companies, including through regular field trips for the bank's executives to Israel (hosted and coordinated by the UKITH). Through these trips, the NatWest Group has been introduced to fintech and other business solutions that have since been adopted across the business - including cybersecurity, fraud protection, customer personalisation and technology to support the bank in its climate ambitions.

Figure 1: Total GVA impact associated with UK inward FDI from Israel, per SIC[7] 1 sector, 2014-2021, by impact channel



Source: PwC IO analysis of BETA and Companies House data

Figure 2: Total employment impact associated with UK inward FDI from Israel, 2014-2021 by impact channel



Source: PwC IO analysis of BETA and Companies House data

5 The total economic impact of Israeli FDI into the UK is slightly lower than the total value of FDI. This is because a significant share of expenditure undertaken by Israeli firms in the UK is on imports, although the share of imports varies by sector. For example, expenditure in the UK on materials, equipment, chemicals or any other goods or services that are imported from outside the UK is not considered part of the GVA economic impact for the UK.

6 Indirect jobs includes employees at firms in the supply chain of Israeli firms undertaking FDI in the UK - for example jobs at UK firms that produce equipment used by Israeli firms in the UK. Induced jobs are those supported by the employees of Israeli firms in the UK spending money in the UK - for example jobs in the hospitality and retail sectors where employees of Israeli firms in the UK spend money.

7 Standard industrial classification of economic activities (SIC)

In addition to the impact generated through business partnerships, the BC and SIN have supported UK-Israel joint research projects with £16m of funding from 2012-2021, predominantly through the BIRAX programme, as well as the SYNERGY Research Mobility programme, Blavatnik Cambridge Fellowships and Wohl Clean Growth Alliance projects. Approximately £8m of this funding has been directed to the UK (as funding is typically shared between researchers in the UK and Israel). The estimated net economic benefits to the UK from this research funding range from a multiplier of **1.53** for grants provided to Israeli early career researchers to study in the UK, with **4.7** for BIRAX medical research in its' first year and 18.3 in its' first four years.

Examples of highly impactful projects the BC's BIRAX funding has supported include:

Queen's University Belfast & Tel Aviv University

A partnership between Queen's University Belfast and Tel Aviv University researching Algorithms for diagnosis and management of age-related macular degeneration. £400,000 of BIRAX funding has been provided to the research project (split approximately 50:50 between UK and Israeli researchers), which has allowed the project to get off the ground (including employing research staff). It has already resulted in improved efficiencies identified in analysing data and medical imaging, and an invitation to present findings at the European Retina Specialists 2022 annual meeting. When completed, the outcomes of the research are expected to deliver significant benefits in terms of clinician and patient time savings (through fewer, shorter visits) and improved health outcomes as patients retain better eyesight for longer.

The University of Cambridge & Technion Israel Institute of Technology

A partnership between The University of Cambridge and Technion Israel Institute of Technology researching using a breath test to diagnose Parkinson's disease. £400,000 of BIRAX funding was provided to the project from 2015-2018 (split 50:50 between UK and Israeli researchers). In a study of 214 people in the UK, researchers found evidence that breath chemical biomarkers can be used to assess Parkinson's disease states in patients, and intend to continue to develop this system into a real world product to be used at the point of care.

Should the Parkinson's breath testing technology identified through this study be rolled out across the UK, it could deliver an estimated £936,000 net economic benefits, **4.7x** the UK's share of £200,000 of funding provided for the study in its' first year and **18.3x** the economic benefits in its' first four years.

Recent years have seen significant growth in the economic and scientific relationships between the UK and Israel. Going forwards there is potential to significantly deepen these ties and the resulting economic impact. One channel identified to achieve this growth is through **increased Venture Capital (VC) investment** from the UK into Israel and vice versa to help startups in both countries expand internationally. UKITH could **provide a wider range of UK companies access to Israeli tech,** building on the experience of NatWest Group to see a continued rise in the adoption of Israeli tech in UK businesses. Finally, **long-term funding commitments for science and academic partnerships** is key to ensure that researchers keep their research products and innovations in the UK until completion.

2. The Embassy's role in facilitating Israeli investment into the UK and providing UK firms access to Israeli tech

The Embassy's role in facilitating Israeli investment into the UK and providing UK firms access to Israeli Tech

British Embassy Tel Aviv (BETA) was established with the objectives of promoting Britain's security, prosperity and well-being, and regional peace through partnership with Israel, as well as providing consular assistance to British citizens in Israel.

However in recent years, the role and impact of the Embassy has expanded significantly, and it is now home to a number of UK Government departments including the UK Israel Tech Hub (UKITH) and Department for International Trade (DIT) who work across trade, investment and innovation to support and foster UK-Israel economic and technological relations. The Embassy's work has played a key role in positioning the UK as the preferred international trade and investment location for Israeli companies, investors and startups, delivering significant benefits to the UK economy and society.

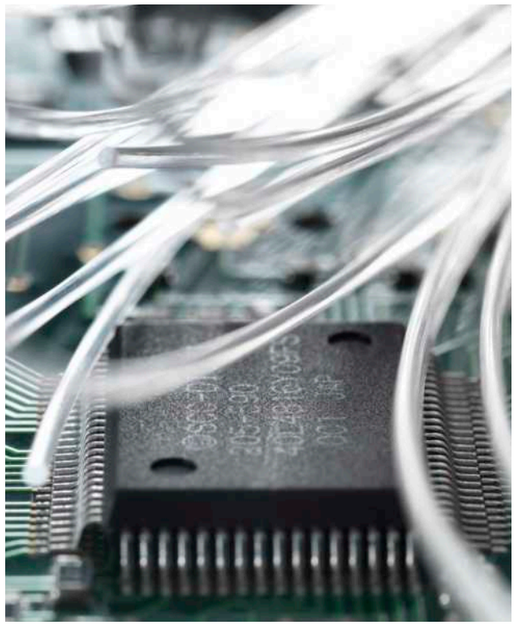
2a) UK Israel Tech Hub

Since its establishment in 2011 the UK Israel Tech Hub (UKITH) has been a vital link between innovative Israeli startups and UK corporations looking to incorporate cutting-edge technological solutions to their businesses. UKITH (based at the Embassy) is part of the Department for Digital, Culture, Media and Sports (DCMS) International Tech Hub Network (ITHN)[8], and operates with the support of the Foreign and Commonwealth Development Office (FCDO). UKITH leverages its proximity to both markets, with offices in Tel Aviv and the UK, to build connectivity between UK VCs and Corporates, as well as supporting Israeli startups to choose the UK as their destination of choice for expansion.

UKITH encompasses many tech and tech-adjacent sectors, with particular focus in three areas: **Healthcare**, **Clean Growth** (including **energy, smart mobility, agritech** and **industry 4.0**), and **Fintech & Cyber.** These growing, high-profile areas match where the UK public (including NHS) and private sectors are increasingly seeking innovative solutions. By developing expert knowledge of the Israeli startup ecosystem across these sectors, UKITH provides a clear pathway for UK organisations looking to access the latest technology being developed in Israel.

The UKITH uses their network to provide targeted access to the vibrant startup eco-system in Israel through:

- **Hosting and coordinating bilateral delegations** including tailored multi-day programmes designed to connect UK executives with Israeli innovators and startups, and show Israeli businesses the best the UK regions and specific industrial clusters have to offer for their international expansion.
- **Workshops, networking sessions and curated pitch events** to expand the UK-Israel ecosystem through targeted programmes to exchange information, seek opportunities for tech firms to collaborate and facilitate introductions.
- Providing **innovation advisory services** to companies looking for business solutions. This includes identifying potential Israeli technology solutions and partners, and proposing models of collaboration between the "buyer" and "seller".



8 Further details on DCMS' International Tech Hub Network are provided in Appendix B

UKITH in action

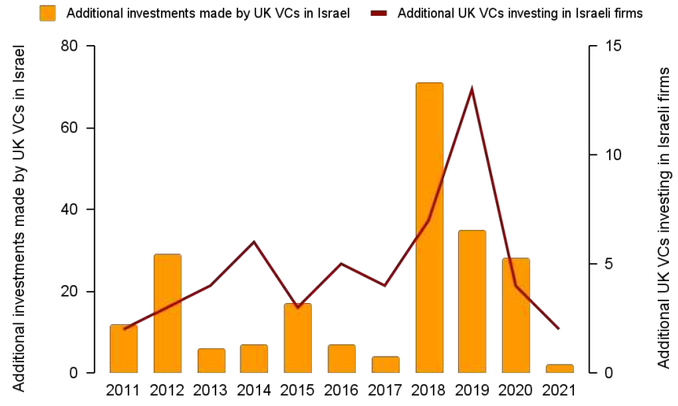
In February 2020, the UK's International Tech Hub Network (ITHN) partnered with the UKITH on their flagship programme TeXchange 2020, which brought a Healthcare Innovation Delegation to London. This supported scale-up technology ventures from across the network to expand into the UK market by exposing British businesses to the world's brightest innovation.

In recent years, UKITH has focused on facilitating a structural relationship between the Israeli tech startup market and the UK's industrial hubs and clusters. Through 'tech gateways' such as the **Leeds-Israel Health Tech corridor** (a health tech corridor between Israeli companies and innovators who are looking to expand into UK healthcare and the NHS in Leeds who are looking for advanced products and innovative ways to undertake clinical work), UKITH connects Israeli companies with consortiums of public and private UK stakeholders, and helps ease the process for Israeli companies to begin operations in the UK. These gateways represent crucial avenues to enable future UK 'superclusters' to access the latest technological solutions, supporting the UK Government's levelling-up agenda and other strategic goals.

Growth of UK VCs in Israel

Key to the rise of Israel's tech and innovation sectors in recent years has been the growth of UK VCs investing in Israeli startups - both in terms of the number of VCs investing and the volume of investments they are undertaking. As shown in figure 3 below, VC investment was high in 2018-19 but was impacted by the pandemic in 2020-21 with a decline in the number of new UK VCs investing in Israel, and the number of new investments being made by UK VCs. However, new UK VC investment in Israel still grew during the pandemic (albeit at a lower level than in previous years), with a total of 53 UK VCs undertaking 218 investments by 2021.

Figure 3: Number of new investments made by UK VCs into Israeli companies, and number of additional UK VCs investing in Israeli companies, 2011-2021



Source: PwC analysis of Pitchbook UK VC fund data, 2011-2021

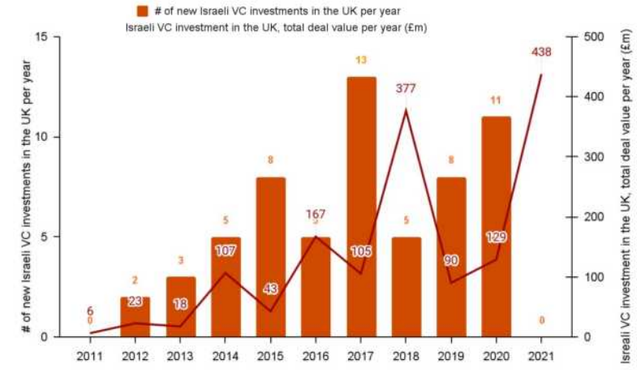
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
New UK VCs investing in Israeli firms	+2	+3	+4	+6	+3	+5	+4	+7	+13	+4	+2
New investments made by UK VCs in Israel	+12	+29	+6	+7	+17	+7	+4	+71	+35	+28	+2

The impact of UK VCs investing in Israeli startups on the UK economy is threefold: i) this investment provides the necessary capital (particularly at the early stages) for Israeli startups to grow and continue to developing their unique, market leading solutions for UK businesses, ii) evidence suggests[9] that as startups grow and look for international expansion opportunities they are likely to consider expansion to countries that have provided them VC funding and can continue providing advice and support as the business looks to expand internationally and iii) UK VCs investing can expect a return anywhere between 25% and 35% per year over the lifetime of their investment[10]. In practice, this means that UK VCs can enable Israeli startups to establish operations and grow in the UK by sharing their local knowledge and connections (support they may not receive if they were to expand elsewhere). **The strength of the relationships built between UK VCs and Israeli startups means that there can be significant long term economic benefits to the UK of UK VCs investing in Israel.**

Growth of Israeli VCs in the UK

In parallel to the growth of UK VC investment in Israel, there has been significant growth in Israeli VCs investing in the UK. **During the period 2011-2021, 41 Israeli VCs made a total of 65 investments in UK companies. From 2011 to 2021 Israeli VCs completed approximately £1.6bn of deals with UK companies**. Nearly 50% of this was investment in information technology, but other key sectors include financial services, consumer products and services and health. 2021 was the strongest year in the past 10 years for Israeli VC investment in the UK, with a total deal value of £438m (although all deals were with Israeli VCs that already had investments in the UK). 2018 was the second highest year with a total deal value of £377m. This has grown from a baseline of £6.29m of deal activity in 2011, representing a 69 times increase in deal value from 2011 to 2021.

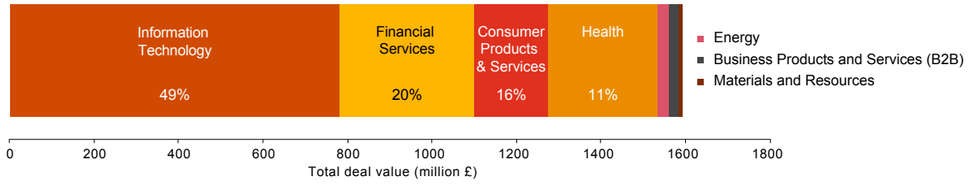
Figure 4: Number of new Israeli VC investments in the UK per year and total deal value of Israeli VCs investing in UK firms by year, 2011-2021



Source: PwC analysis of Pitchbook Israeli VC fund data, 2011-2021

Figure 4 above indicates that the pandemic has had minimal impact on Israeli VC investor confidence in terms of undertaking new investments into the UK. While there was a decline in deal value from 2018 to 2019, deal value rose in 2020 and then again in 2021, to a peak of £438m of deal value. Notably, there were no new Israeli VCs investing in the UK in 2021, so all £438m of deal value was undertaken by VCs that already had investments in the UK.

Figure 5: Total deal value by Israeli VCs in the UK (millions £), 2011-2021, by primary industry



Source: PwC analysis of Pitchbook Israeli VC fund data, 2011-2021

9 In 2018, 14 out of the top 25 destination countries for greenfield FDI projects on fDi Markets were also among the top 25 countries in terms of VC availability, suggesting that countries with a high availability of early-stage company funding also attracted tangible cross-border investment from foreign companies, including startups. Source: How venture capital helps start-ups expand globally, fDi intelligence, March 2020, https://www.fdiintelligence.com/article/76766

10 Harvard Business Review, 1998. How Venture Capital Works. https://hbr.org/1998/11/how-venture-capital-works

Through connections with DIT and other Government and industry bodies, UKITH works alongside Israeli startups as they grow and expand into the UK market. The relationships held by UKITH across UK Government enable Israeli firms to access a wide range of support when they decide to enter the UK market. Case study 1 below presents an example of where a relationship pioneered by the UK Israel Tech Hub has subsequently been handed over to DIT to provide specialist trade and inward investment advice and support as REE Automotive established engineering, manufacturing and other operations in the UK.

Case study 1: REE Automotive

Overview of REE Automotive

REE Automotive (REE) is an Israeli automotive technology company developing electric vehicle (EV) platforms that can be used to power a wide range of commercial vehicles. The technology developed by REE enables auto manufacturers, OEMS, delivery fleets, and new mobility players to build electric and autonomous cars, vans and trucks in virtually any size or shape, for any application, and any target market. REE's concept allows a completely flat and modular electric chassis (REEboard™) and provides customers with design freedom to create a broad range of electric and autonomous vehicles; this represents a completely new way to develop EV fleets. REE has developed two core innovations: the REEcorner™ which integrates all traditional vehicle components into a compact module between the chassis and the wheel, and the REEboard™ which contains the battery pack and provides the largest possible usable space for cargo and/or passengers. The combination of these two technologies enables maximum flexibility in terms of vehicle dimensions, and reduces the time and investment required to develop EVs. Flexibility to size of the vehicle and driver position economises on space, and REE's technology significantly reduces the time and investment required to develop EV vehicles. The company was founded in 2011, came out of stealth mode in 2019, and began trading publicly (NASDAQ:REE) in July 2021.

Background to REE's interest in the UK

REE was attracted to the UK by the presence of one of the world's largest automotive technology clusters, centered around the West Midlands and Thames Valley. Thanks partly to its 50-year domination of Formula 1 motorsport, the area has the world's largest number of advanced engineering companies that can apply leading-edge motorsport solutions to on-road applications. The presence of Horiba MIRA in Nuneaton, home to over 30 automotive technology companies, also enabled a "soft landing" in the UK with a ready-made technology and commercial ecosystem. There was global competition in the decision to house its' Engineering Centre, and the UK was judged the most favourable. The existing supply chain and access to talent in the UK was crucial; already more than 150 personnel have been recruited. A favourable and accommodating regulatory environment, with clear support for REE and the industry as a whole, also proved a decisive factor.

How the Embassy (UKITH and DIT) supported REE's expansion to the UK

The Embassy played a large role in bringing REE and the government together, and ensuring the process of investing in the UK was as smooth as possible. Whenever a delegation of ministers would visit Israel, the strong connections fostered by the Embassy ensured that REE were invited to discuss barriers and explain the support they needed. The Embassy made introductions to leading UK automotive stakeholders, UK Government authorities and initiatives that could support their mission.

Following its launch in the UK REE has made significant investments in the UK

REE anticipates total investment in the UK will be approximately $90 million (£68.9m) for its 'Engineering Centre of Excellence' and Integration Center in the UK between 2021 and 2023.

In 2021 REE established its first UK engineering centre in Nuneaton employing 130 staff, and in March 2022 took a lease on a site for an Integration Center in Coventry. This Integration Center will develop the production technology to be used in the integration centres that REE will build across the world: the UK hub will be responsible for developing the entire production process of all future REE models. **By 2024, REE will employ nearly 300 people in the UK.** Since late 2021 they have manufactured REEcorner™ units, a validation platform incorporating four REE corners, and performed track-tests of the validation platform.

One of REE's first UK projects with this investment is to develop and productionise "REEcorner™ Technology" (RCT), enabling a radical redesign of medium-sized commercial vehicles up to 7.5 tonnes. The project will facilitate mass production of its innovative REEcorner™ technology and EV platforms including engineering design, validation, verification and product testing. REE's fully-flat, ultra-modular EV platforms offer superior payload capacity by providing more room for carrying passengers, cargo and batteries as well as enhanced body design flexibility and autonomous capability. **REE's RCT project has a total investment of £41.2 million** with £12.5m funding from the UK Government through the Advanced Propulsion Centre (APC). The project runs from November 2021 to January 2024.

On the completion of RCT in 2024, the UK operation will develop a range of new products and plans to continue to expand its business in the UK and abroad.

The impact of REE on the UK Economy

	GVA Impact	Employment Impact
Direct	£26,712,154	300
Indirect	£18,313,902	307
Induced	£15,570,7288	224
Total	**£60,596,784**	**831**

REE is developing new technology with many UK partners and suppliers. The pilot line in Coventry will produce 10,000 REEcorner sets per year (40,000 corners), and the majority of the total parts count of the production vehicle will come from UK suppliers. This is the benefit of operating as part of the automotive cluster in the West Midlands. Using an Input-Output model, the potential recall impact of the $90 million (£68.9m) investment REE has committed to the UK can be quantified. The table above shows that REE is expected to have a direct GVA impact of £26.7m, with additional £18.3m and £15.6m of GVA impact through the indirect and induced channels[11]. In terms of employment, IO modelling indicates this investment can support 300 FTE jobs directly, which matches with REE's estimate of 300 jobs created by 2024. Additionally, 531 further FTE jobs would be supported from this investment, 307 through business to business (indirect) spending and 224 through the induced spending of labour income for employees in the impacted supply chains.

> "What we have right now is a huge success story, of an Israeli company establishing in the UK and employing more than 150 personnel, with UK funding, all in less than a year. This could not have happened without the Embassy."
>
> Keren Shemesh, CMO REE

11 The $90 million total investment from 2021-2023 is converted to Pound Sterling using the exchange rate as of 21/04/2022.

A key driver of UK-Israel business relations in recent years has been the rise of the Israeli tech sector, and the innovative business solutions this has presented for UK companies. UKITH has played a critical role in connecting UK businesses with Israel tech companies offering unique and market leading solutions - from startups to established multinationals. UK businesses and the wider UK economy have benefited significantly from increased access to Israeli tech and the subsequent economic activity it has generated in the UK. One particular example, **UKITH's relationship with NatWest Group** is presented in case study 2 below.

Case study 2: NatWest Group

Background to NatWest Group's relationship with UKITH

Since 2015, NatWest Group has worked closely with UKITH to explore the innovative tech solutions available in Israel and build connections across the Israel tech ecosystem. After being introduced to UKITH in 2015, NatWest Group undertook an initial scouting exercise with UKITH across Israel to understand if there was value in exploring potential partnerships. This exercise was led by the Group's global scouting and research team[12] who scout for global tech solutions that can be adopted at NatWest Group to improve business operations and customer satisfaction. Following a successful scouting exercise, the bank has since sought to build strong relationships with the Israeli tech sector.

How UKITH has supported NatWest Group

NatWest Group has conducted 14 executive field trips since 2015 with the support and guidance of the UKITH. Each trip is centred around a theme based on NatWest Group's business challenges at the time (or in the foreseeable future). To prepare for the trips, UKITH works with NatWest Group's Senior Management to understand what their challenges were - for example when the retail business wanted to offer increased customer personalisation they wanted to understand what Israel could offer in this space specifically.

Each field trip has a 3-4 day duration for 2-3 NatWest Group executives. UKITH coordinates full days of activities (from 8:30am into the evening), scheduling a mix of conferences, speaker events with fintech and roundtable discussions, all centred around the trip theme. On these field trips, UKITH also supports the bank to meet with their existing Israeli partners and expand on solutions already in place.

NatWest Group works with UKITH and the Embassy to look for business solutions in Israel that extend beyond financial services, banking and traditional FinTech. In particular, UKITH connected the NatWest Group with an Israel based organisation focused on how Israeli technology can support companies and governments to address the UN's Sustainable Development Goals (SDGs). The NatWest Group has worked with Israeli firms to consider how they can address social and environmental challenges including:

- Understanding how technology could provide additional oversight and awareness of potential financial and economic abuse indicators
- Considering green tech options that link into NatWest Group's green agenda, particularly as they were a major partner for COP26 and understand green tech to be high on their clients' agenda.

> "The UK Israel Tech Hub are our people on the ground in Israel. They are critical to helping the NatWest Group find and connect with the best technology Israel (and the world) has to offer. We can then bring this technology back to the UK to strengthen and protect our business and customers"
>
> Elaine McLaughlan, Head of Scouting Israel & Asia Pacific, NatWest Group.

12 NatWest Group has a research team focused on identifying disruptive/emerging technology and innovative solutions that can support the business to address the key challenges they and their customers face. NatWest Group has scouting teams based in the UK and Silicon Valley that review available technology in the UK/ Europe and the Americas respectively.

Israeli tech has been successfully adopted within NatWest Group

Through the work of the UK Israel Tech Hub, the bank has been able to access and implement a range of fintech and customer personalisation innovations developed by Israeli firms including:

Fraud detection 1

The NatWest Group uses Nuance voice biometrics technology to quickly detect fraud attempts coming into its call centre and disrupt organised crime activities across all its customer engagement channels

Cyber security and protection 2

Worked with Israeli cyber company for domain protection for suspicious activity

Customer banking personalisation 3

As part of the bank's innovation agenda to use data and advanced analytics to understand and respond to changing customer preferences, the NatWest Group has partnered with Earnix to help bring together key information on how it can best serve its customers' financial needs and risk profile when the bank deployed Earnix's software to support its personal unsecured loans business

Behavioural Analytics 4

Keeping customers safe from cyber attacks and fraud is a critical imperative for banks. The scouting team discovered a leading behavioural biometrics firm from Israel who are able to capture customer online banking behaviour and distinguish this against potential hackers or malicious account takeovers. This enables the bank to prevent online fraud attempts and protect their customers. NatWest Group noted it's unlikely they would have found this company through their traditional channels if they didn't have a scouting network in place.

Optimising digital marketing, website content and analytics 5

The bank has worked with Israeli tech firms to optimise their website marketing and review website abandonment, enabling the customer to have a better experience and be able to fulfil their customer journey online

Key benefits Israeli Tech has brought to NatWest Group and the wider UK economy include:

- Sharing of Tech leaders knowledge to key Executives across the bank
- Increased security for the bank and protection for customers
- Improved customer personalisation, improvement in bank risk profiling
- Frictionless and improved customer journeys

The outlook for NatWest Group's relationship with the Israeli tech ecosystem

Going forward, there are significant opportunities for UK organisations to access innovative technology solutions to continue to improve business efficiency and operations. NatWest Group and UKITH are looking to expand their relationship to support the bank's corporate clients to access Israeli tech and realise the benefits. In the short term this is planned to include the delivery of virtual conferences and events to connect the bank's clients with relevant Israeli innovators and firms that can potentially support them.

Building on the relationships enabled by UKITH, NatWest Group's Entrepreneur Accelerator programme has provided a free platform for Israeli startups to launch their business in the UK. The bank's accelerator programme supports entrepreneurs by providing them with office space, mentorship, and networking opportunities as part of its two to six-month programmes. To date, 17 Israeli startups have launched in the UK through the bank's Entrepreneur Accelerator, demonstrating the NatWest Group's commitment to building bilateral relationships between the UK and Israel, supplementing the work of the Embassy and UKITH.

While NatWest Group has worked with a number of organisations in Israel to help them connect with the Israeli tech sector, as a result of the successful partnership with UKITH since 2015, from 2022 onwards UKITH will be their exclusive partner on the ground in Israel going forward. This is a testament to the quality of work the UKITH has done with the bank and the impact access to Israeli tech has had on the business.

2b) Department for International Trade

The Department for International Trade (DIT) works with Israeli firms looking to undertake Foreign Direct Investment (FDI) and capital investment in the UK. Working as a department located within the Embassy, DIT's activities are a key driver of inward investment to the UK, particularly as DIT's presence on the ground in Israel helps bring a deep understanding of the needs of Israeli investors looking to undertake foreign investment. Having a presence as part of the Embassy helps DIT identify and alert Israeli companies of opportunities in the UK where there is demand for their products and services.

In recent years Israeli companies have been somewhat constrained by the size of their domestic market and fast growing Israeli companies have looked abroad to expand and establish new operations.[13] DIT's work in Israel has helped advocate for the UK to be their destination of choice. Bringing together knowledge and insight across both the UK and Israel, DIT targets companies operating in sectors aligned to UK Government priorities (and with strong growth prospects in the UK), including **tech** and **health & life sciences.**

Key activities undertaken by DIT to attract and retain Israeli FDI in the UK include:

- Events and conferences to advertise the UK and attract / engage with potential investors interest
- DIT trade advisors host Israeli delegates and visitors to promote opportunities across the UK
- Introducing Israeli companies to UK based industry networks, legal and distribution services to support their market entry
- Providing investors assistance to obtain subsidies and raise awareness of funding available
- Providing assistance to navigate customs, legal and regulatory requirements, helping lowering the barriers to entry
- Direct approaches to target investors and pension funds to enable capital investment into the UK.

In addition to the £1.2bn FDI secured by the Embassy and DIT, capital investment from Israel to the UK has been a key driver of the strengthening relationship between the two countries. Table 1 below highlights the **£428m** of capital investment from Israel to the UK that the Embassy and DIT helped secure from 2015 - 2020. Although capital investment and general business confidence was disrupted by the onset of Covid-19 pandemic in 2020, in the years prior there were a number of large capital investment projects from Israel into the UK that were successfully secured thanks to the work of the Embassy and DIT. This investment has been undertaken across a range of sectors including infrastructure, energy (including renewables)[14] and real estate (including hotels and aged care).

Table 1: Israeli capital investment committed with DIT support (i.e. DIT "wins"), announced in 2015-2020, £m

	2015	2017	2018	2019	2020
Capital investment secured by DIT and the Embassy	£77m	£115m	£60m	£124m	£52m

Note: The table represents capital investment wins announced in each year, and is in addition to FDI undertaken by Israeli firms in the UK. 2016 is excluded from the table above as no data was available for this year.

13 Source: BETA

14 See case study 4 on Helios Energy Investments which provides an example of some of the Israeli capital investment wins supported by DIT.

20+ FDI projects secured

£1.2bn invested into the UK

Since 2011, DIT has helped secure 20-25 FDI projects annually across 8 key sectors including: Information & Communication; Manufacturing; Transportation & Storage; Finance & Insurance, Accommodation & Food Services; Professional, Scientific & Technical Services; and Agriculture, Forestry & Fishing.

This has led to a total of £1.2bn FDI invested by Israeli firms into the UK from 2014-2021.

DIT provides practical support to companies when they are looking to set up operations in the UK, including regulatory, taxation and legal advice, as well as assistance identifying appropriate sites for their business activities. A recent case study of DIT activities at the Embassy supporting an Israeli firm set up operations in the UK (and subsequently grow their EMEA business from a London HQ) is Optibus.

Case study 3: Optibus

Background to Optibus

Optibus is an end-to-end, **cloud-native solution** for transportation planning, scheduling, rostering, and operations, powered by artificial intelligence (AI) and optimisation algorithms. Founded in 2014 in Israel, the company's platform is now used in over 1,000 cities globally enabling operators and agencies to make transportation smarter and more efficient. Optibus has been recognised as a technology pioneer by the World Economic Forum for its role in transforming the transportation industry, promoting equity, sustainability and smart cities.

Support provided by the Embassy for Optibus' expansion to the UK

Looking to expand from its roots in Tel Aviv, Optibus launched its AI optimization solution in the UK market in August 2018 with the Embassy and DIT being a key advisor in the expansion process. DIT provided operational support from the start, assisting Optibus in setting up the legal entity, identification of office spaces, and tax advice. To support Optibus to succeed in the UK, the Embassy was also instrumental in arranging introductions with investors, trade shows, exhibitions and networking with the UK Government and Transport Committee.

"If I was to talk to another Israeli company looking to set up in the UK, I would be really happy to tell how great the services of the British Embassy Tel Aviv are … The level of service provided was fantastic and I would have expected to receive that level of service from a paid consultancy that I retained, and yet they were providing that service based on goodwill and investment in another country. I rate that service as excellent"

Dave Joshua, EMEA General Manager, Optibus

The UK transport system (with a franchise system in London and a deregulated market in the other cities and regions) provided a significant opportunity for Optibus to offer its platform to improve efficiency in the sector. Starting with First Bus (second largest regional bus operator in the UK) as Optibus's first UK client, the Embassy was helpful in brokering conversation with numerous clients over the years and accelerating Optibus's growth in the UK market. Optibus' platform is now involved in running around half the public bus services in the UK, including over 80% in Scotland and 40% in London.

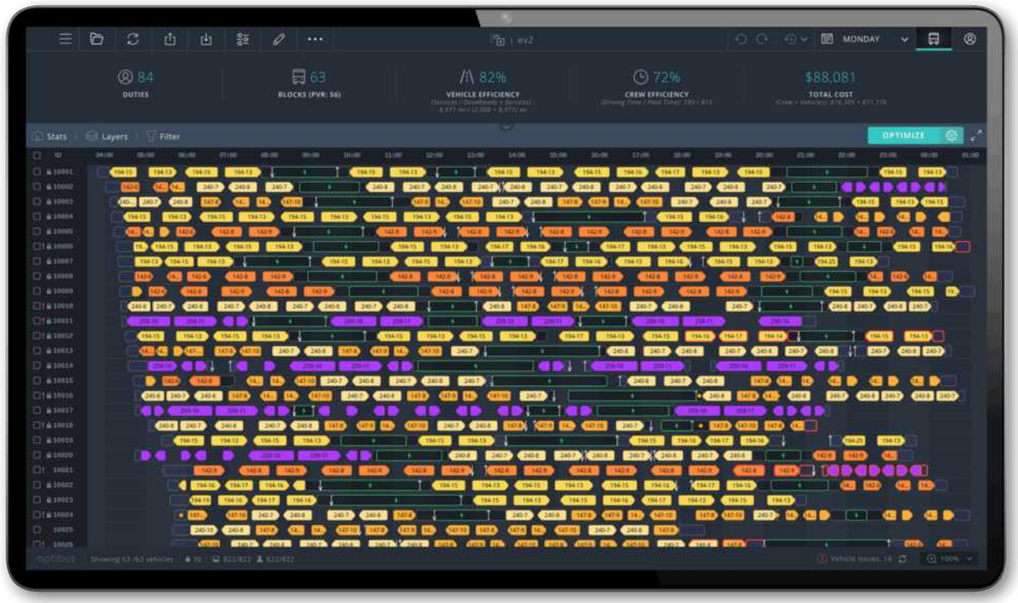
Impact of Optibus' investments in the UK

In their 4 years of operations in the UK (2018-2022), Optibus has invested tens of millions of pounds into the UK and established London as their EMEA headquarters. The number of individuals employed in the UK has increased exponentially from around 35 at the start of 2020 to over 200 in 2022. Optibus now works with over 50% of the UK bus market, including FirstGroup, Stagecoach Group, Arriva, Abellio Group and more. Further growth has been driven by Optibus' EMEA expansion, as it is now working with the transport sector in Italy, Portugal and Uganda, and around 50% of jobs related to those contracts are based at the London HQ. This is a testament to the talent pool they have been able to access in London as Optibus has a diverse workforce where 38% of employees are non-UK natives that now live and work in the UK for Optibus. These are jobs that Optibus says would not have existed in the UK without the support of the Embassy in helping them build their worldwide business from London.

During the height of the pandemic, when lockdown meant that usage of public transport fell to 20% of pre-2020 levels, Optibus invested £1m-£2m in providing free support for 3 to 6 months to new clients and helping public transportation run effectively in parts of the UK to minimise losses while ensuring public transportation services for essential workers. This included support for engineers and planners through provision and education about the software platform, while enabling them to easily and quickly scale their operations according to fluctuating demand and requirements. As a result, in 2020 alone the number of public agencies and private operators using Optibus doubled, while the business made zero turnover.

Recently, Optibus has increased its investment in the UK and expanded their Spitalfields premises. As the business has grown from 2 desks in Paddington to over 100 desks in Spitalfields, the Embassy has been crucial throughout this expansion in supporting searches of office locations and connecting with the local networks. With 35% of Optibus staff now working remotely outside London, the business is also planning further expansions across the UK with regional offices in Bristol, Manchester, Glasgow and Dublin.

As Optibus looks ahead to planning the growth of their service offering to light rail, tube and coach network, they see the Embassy and DIT as crucial partners in providing on-going support and access to large delegations (such COP 26), exhibitions and conferences.



DIT provides practical and strategic advice to companies looking to undertake investment in the UK, including communicating policy priorities and identifying opportunities for international investors - for example in the UK's energy transition. A recent case study of DIT activities at the Embassy supporting an Israeli firm to invest in the UK's net zero transition is Helios Energy Investments.

Case study 4: Helios Energy Investments

Background to Helios Energy Investments

Founded in 2010, Helios Energy Investments is an infrastructure investment firm based in Tel Aviv that invests in long-term income-generating renewable energy projects, to develop and manage over a period of several years. Now in their fifth round of funding, their investors are primarily institutional capital from Israel looking to invest in energy and the energy transition across Israel and Europe. Starting with projects in solar energy, Helios now focuses on waste-to-energy (including anaerobic digestion) power generation and has become the largest Israeli fund in that market. Operations in Europe are expanding, with Helios already active in the UK, Italy, Spain, Poland and the Netherlands.

Support provided by the Embassy and DIT for Helios' investment in the UK

The Embassy and DIT have been supporting Helios since they first showed interest in the UK market. After having trouble with the regulatory regime in Italy (the site of its first European investment) in 2013/14, their interest switched to the seemingly more stable UK environment. Helios immediately contacted the Embassy for support in entering the UK market. The Embassy proved instrumental in helping Helios understand the UK market and opportunities, including arranging trips to the UK and introducing Helios to potential financial partners, banks, engineering and construction firms, and developers. By making it easy to understand the UK ecosystem and ways of doing business, as well as develop its network, the Embassy's support enabled Helios to make a small initial investment in 2014 to test the market.

> "During that early period, the team at the British Embassy in Tel Aviv was very supportive both in information and responsiveness, as well as arranging visits in the UK…The trips helped us meet several service providers, potential financial partners and banks, that has helped us develop the Helios ecosystem as it is today… British Embassy have a lot of credit in the success of Helios over the years, due to their early support."
>
> Erez Gissin, Founding Managing Partner, Helios Energy Investments

Expansion of Helios' investments in the UK

Since that initial investment, Helios has expanded into the UK substantially, making the UK its largest market outside of Israel. Partnering with two British funds that it was introduced to through a trip organised by the Embassy and DIT, Helios made its first waste-to-energy investment, founding a platform now known as BioEnergy Infrastructure Group (BIG). Without prior experience in the waste-to-energy market, the connections to other investors facilitated by the Embassy were crucial in enabling this investment to be made. BIG now manages six plants across England, Scotland and Northern Ireland with a total of 104MW capacity, directly employing around 150 workers, with third party vendors supporting the employment of hundreds more.

Helios' operations in the UK have continued to grow, co-founding Bio Capital Limited in 2018 as a platform for investments in Anaerobic Digestion plants in the UK, now with 7 sites across the UK. In early 2019, Helios opened an office in London, from which to base its investment and management activities in Europe, which continues to grow. Helios committed a total of £205m in capital investment to the UK from 2014-2020 and acknowledges the Embassy and DIT's support in its success. Further capital investment in the UK is expected to be committed in 2022 and beyond.

Helios' ongoing engagement with the Embassy and DIT

As its network in the UK has developed, Helios has decreased its reliance on ongoing support from the Embassy and DIT. However, long lasting relations remain and Helios continues to engage for support in navigating specific regulatory obstacles with local authorities and the UK government. Helios aims to be involved in supporting the UK's energy transition into the future. With a planned foray into the energy storage sector, Helios expects the Embassy and DIT's networks and knowledge will potentially help it understand and anticipate a developing regulatory framework.

2c) Economic impact of Israeli investment into the UK

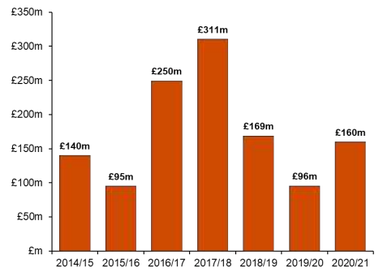
The UK is the number one destination for inward investment in Europe[15], and London is the most popular city in the world with £2.6bn of inward FDI from 2015-2020[16]. The second and third ranked cities are Singapore and New York with 3,832 and 2,854 projects respectively over the same period. This consistent demand is largely due to:

- strong demographic and economic growth;
- a broad and diverse range of markets, infrastructure and capital projects;
- access to talent and skilled labour; and
- levels of innovation and technological advances.

Although the publicly available data on inward FDI in the UK from Israel is sparse,[17] from ONS data it is possible to estimate that the total inward stock of FDI from Israel to the UK in 2019 stood at between £15.5bn and £19.1bn when measured by the ultimate controlling country.[18] As a result, this analysis instead relies on survey data collected by the the Embassy on FDI from Israel to the UK that they have supported.[19] As a result this study reflects FDI in some way enabled by the Embassy. Note that this study uses data on FDI **flows**, which measures the amount of new FDI in each calendar year, as opposed to the existing stock of Israeli-controlled businesses in the UK, the **stock** of FDI.

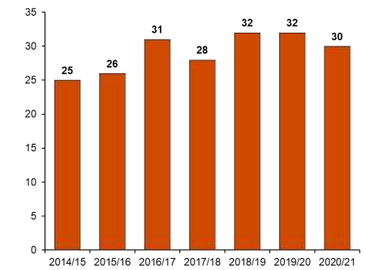
From 2014 to 2021, over £1.2 billion of FDI has flowed into the UK from Israeli companies, with a peak of £311m in the 2017/18 financial year. The number of investments per year has grown slightly over the period. In both 2018/19 and 2019/20, the Embassy's data shows there were 32 distinct investments made by Israeli companies into the UK. The average investment value in later years, from 2018-2021, has fallen, perhaps unsurprisingly, given the additional uncertainty caused by the COVID-19 pandemic.

Figure 6: UK inward FDI flows from Israel per year, 2014-2021, (2021 £)



Source: PwC analysis of BETA data

Figure 7: Number of inward FDI investments from Israel to the UK per year, 2014-2021



Source: PwC analysis of BETA data

The manufacturing and Information & Communication sectors stand out as having received the most inward investment from Israel. Far from being due to single large projects, these sectors have received steady inflows of FDI over the period. The sector mix has remained fairly unchanged, at the SIC 1 level, across the years of analysis; manufacturing and information & communication industries feature in the top 2 recipients of FDI inflows from Israel for most years in Table 2 below.

15 UK Trade and Investment (UKTI), The UK: The Number 1 Destination for Inward Investment (FDI) in Europe, https://www.youtube.com/watch?v=R0UT6TGstEI

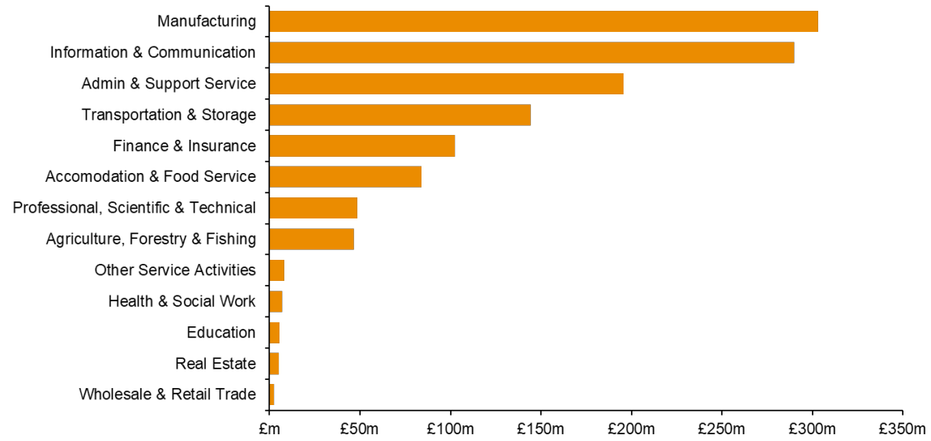
16 fDi's Global Cities of the Future 2021/22, https://www.fdiintelligence.com/article/79334

17 Traditional sources for FDI data such as the Office of National Statistics (ONS), OECD or the International Trade Centre (ITC) do not publish breakdowns of Israel's FDI positions by partner country or industry to mitigate the disclosure of sensitive data

18 Office of National Statistics, Foreign direct investment by ultimate controlling economy, UK trends and analysis: July 2021, https://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/articles/ukforeigndirectinvestmenttrendsandanalysis/july2021#:~:text=The%20US%2C%20Japan%20and%20Jersey,in%202019%20(Figure%202).

19 The following analysis and the estimates of the impact on the UK economy therefore underestimate the total impact of FDI from Israel, and represent only that which has been in some way enabled or assisted by the Embassy. The data selection considerations are detailed further in Appendix E.

Figure 8: UK inward FDI flows from Israel, 2014-2021, by industry[20]



Source: PwC analysis of BETA and Companies House data

Table 2: The top two SIC 2 sectors that received the most inward FDI flows investment from Israel to the UK, per year 2014-2021

Sectors with highest inward FDI from Israel						
2014/15	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**
Manufacturing	Information & Communication	Finance & Insurance	Admin & Support Service	Information & Communication	Information & Communication	Manufacturing
Transportation & Storage	Manufacturing	Information & Communication	Information & Communication	Manufacturing	Manufacturing	Accommodation & Food Service

Approach to economic modelling

This study uses input-output modelling (IO modelling), to estimate the total economic benefits to the UK as a result of the inward FDI from Israel to the UK. The two measures of economic impact used are:

- **Gross Value Added ("GVA"):** This is a measure of the value associated with FDI in the economy, and represents the difference between the value of goods and services sold and the goods and services used as an input in their production.[21]
- **Employment**: This measures the number of full-time equivalent (FTE) jobs that are associated with FDI.

Input-output analysis allows us to understand the impact of Israeli FDI to the UK economy through three channels. These are:

- **Direct Impact:** The GVA and employment associated with Israeli FDI into the UK.
- **Indirect Impact:** The GVA and employment associated with the production of goods and services along the supply chain of firms that receive capital investment spending.
- **Induced Impact:** The GVA and employment associated with the wages being spent by employees employed directly as a result of FDI and other firms along the supply chain.

20 Industry breakdown based on Companies House classification of business activities. In some cases e.g. Admin & Support Service the company activities may also be aligned to other sectors e.g. Finance & Insurance, however for consistency this analysis has been undertaken using Companies House classification.

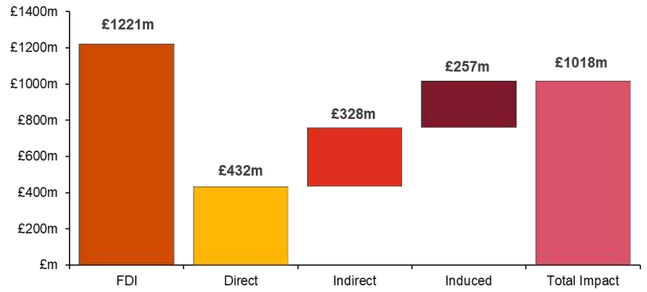
21 GVA is similar to Gross Domestic Product ("GDP"), another measure of economic output. The two measurements differ in their treatment of taxation and subsidies. GVA is equivalent to GDP plus subsidies minus taxes.

Modelling results

Overall Gross Value Added (GVA) Impact

Figure 9 presents the total Gross Value Added impact of the £1.221bn of inward FDI between 2014 and 2021. Of the £1.018bn total, £432m was generated through the direct investment spend, £328m through the resulting business to business spending that occurs through the supply chain, and £257m from the spending of the labour income for employees within the business' supply chains. The total GVA impact to the UK is 83% of the initial investment.

Figure 9: Total inward FDI from Israel to the UK and resulting GVA impact, 2014-2021, by impact factor

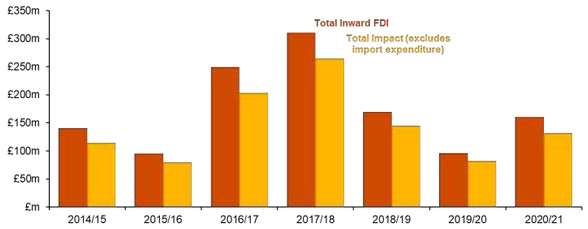


Source: PwC IO analysis of BETA and Companies House data

This ratio of impact to total FDI spending is broadly consistent across the years analysed. As a result, Figure 10, which shows the inward FDI and resulting GVA increase in the UK follows a familiar pattern. The largest FDI and resulting impact is seen in 2017/18, and FDI is beginning to recover following a dip during the pandemic. Figure 11 presents the GVA impact per year broken down by impact channel, which demonstrates the consistent split across periods.

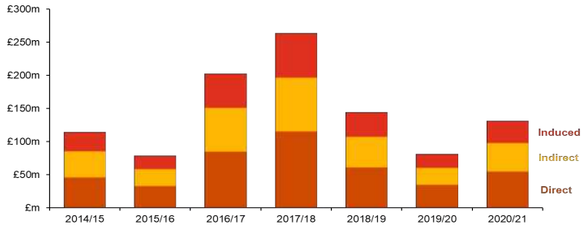
This methodology accounts for the proportion of investment spending by companies in the UK that goes to imports (i.e. leakage from the UK economy). The benefits of this business-to-business spending down the supply chain, or the induced effect from employee spending, will not accrue to the UK. As a result, the total economic impact from FDI is lower than the initial amount of FDI flowing into the UK, because of where money is eventually spent.

Figure 10: Total UK inward FDI from Israel and resulting GVA impact, per year, 2014-2021



Source: PwC IO analysis of BETA and Companies House data

Figure 11: Total GVA impact of UK inward FDI from Israel, per year, by impact channel



Source: PwC IO analysis of BETA and Companies House data

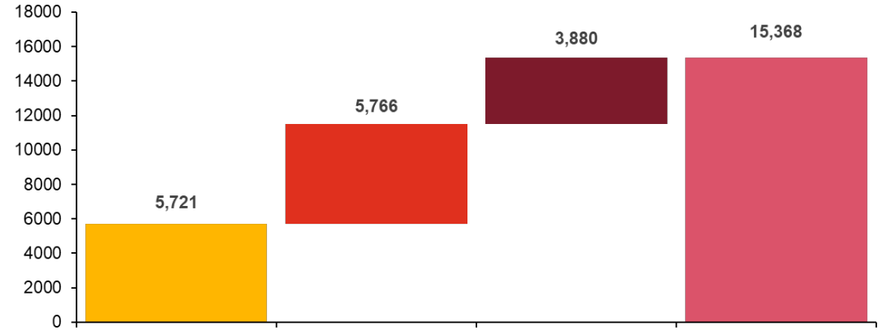
Overall Employment Impact

The IO analysis also considers how FDI coming from Israel into the UK has supported UK employment, decomposing total impact into direct, indirect and induced channels. As shown in Figure 12, over the period 2014-2021, 15,368 FTE jobs have been supported as a result of FDI from Israel. 5,721 jobs were supported as a result of the direct investment, 5,766 jobs generated in the supply chain of businesses where investments were spent, and 3,880 jobs were generated from the spending of labour income throughout the economy.

The financial year 2017/18 represented the peak of jobs supported in a single year, with 3,979.[22]

This figure of 5,721 jobs created as a direct result of the investment aligns with the survey data collected by the Embassy from companies undertaking FDI in the UK. This provides a positive indication that this IO modelling and underlying assumptions are capturing an impact of a reasonable magnitude.

Figure 12: Total employment impact associated with UK inward FDI from Israel, 2014-2021, by impact channel



Source: PwC IO analysis of BETA and Companies House data

*The financial year 2017/18 represented the peak of jobs supported in a single year, with 3,979.

Impact by Sector

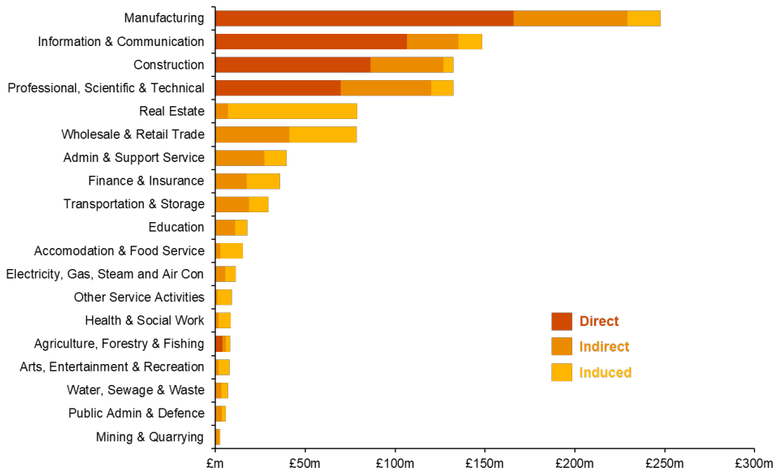
The IO analysis also considers how total GVA impacts are distributed across SIC1 sectors. As shown above in Figure 8, FDI into Israel is concentrated in the manufacturing and information & communication sectors. It is therefore unsurprising to see that these sectors benefit the most from this investment, due to sizable direct impacts. Over the period 2014-2021, FDI into the UK from Israel results in £247m of additional GVA in the manufacturing sector. £166m of this comes from the direct channel which, at 67% is a high proportion. £63m comes from the indirect channel, and £18m from the induced channel.

It should be noted that only some sectors exhibit direct effects. This is because the initial 'direct' spend is taken as not the FDI itself, but where companies that receive FDI make investment spending. This is given by the Gross Fixed Capital Formation table from the ONS, and therefore investment spending only flows into certain industries.

The construction and professional, scientific & technical industries also exhibit large GVA benefits, due to being a common destination for Gross Fixed Capital Formation. Much of the investment spending that firms in FDI heavy sectors make go through these industries, along with manufacturing and ICT. The real estate and retail trade sectors exhibit significant growth in GVA despite no direct effects, which is likely due to the fact that these are popular spending destinations for labour income and, in the case of wholesale trade, in business-to-business spending. The induced effects in particular are relatively larger in these sectors, at 69.8% and 53.2% respectively.

22 These are jobs created in the time the investment is made. In the IO model, it is assumed the investment takes place all in the given financial year. The length that these jobs remain is outside the scope of the model.

Figure 13: Total GVA impact associated with UK inward FDI from Israel, per SIC 1 sector

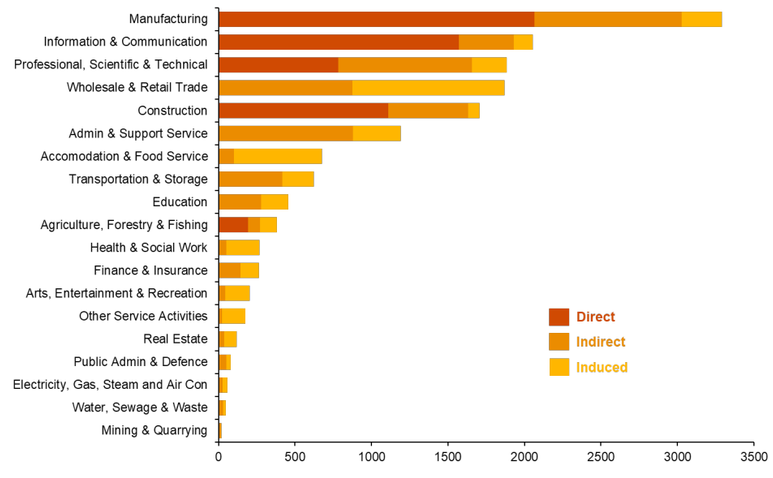


Source: PwC IO analysis of BETA and Companies House data

The employment impacts have a similarly wide dispersion across industries when considering where those jobs are created. The manufacturing sector again has the highest employment, with a large direct impact and a robust indirect employment impact, likely due to manufacturing firms being a common feature of many industries' supply chains. The direct jobs created in the manufacturing sector as a result of the inward FDI was 2064, with 962 and 265 jobs being created through the indirect and induced channels.

In a similar way, several sectors exhibit a larger relative jobs impact than GVA impact, such as Wholesale & Retail Trade and Professional, Scientific & Technical, due to being more labour intensive industries, where a given unit of output is associated with relatively more employment than the construction sector, for example.

Figure 14: Total employment impact associated with UK inward FDI from Israel, per SIC 1 sector, 2014-2022, by impact channel



Source: PwC IO analysis of BETA and Companies House data

Spillovers from inward FDI from Israel to the UK

Depending on the nature and type of FDI being undertaken by Israeli firms in the UK, there may also be positive spillovers to local firms and sectors including building local knowledge, skills, capabilities and technologies. There are two main categories of spillovers likely to occur as a result of Israeli FDI into the UK: Pecuniary and Non-Pecuniary spillovers.

Pecuniary spillovers are spillovers from FDI in the form of induced supply chain activities and greater employee spending. The pecuniary spillovers from Israeli FDI into the UK are quantified in this study through the indirect and induced impacts in the economic impact analysis. The total value of pecuniary spillovers from Israeli inward FDI into the UK from 2014-2021 is estimated as **£328m** in GVA from direct spending on supply chains and **£257m** in GVA throughout the economy via the additional spending of employees.

Non-pecuniary spillovers are non-financial spillovers, including knowledge spillovers. These occur when the activities of Israeli firms operating in the UK affect the technological endowment of UK firms, either vertically (within an industry via supply chain) or horizontally (across industries).

Non-quantifiable knowledge spillovers from FDI typically occur through three channels:

- **Skills transfer –** when an Israeli firm provides training to local employees, who eventually leave the company to join domestic competitors or to form their own, taking their knowledge with them.
- **Vertical supply chains within an industry –** Israeli firm transferring production knowledge and techniques to upstream suppliers to bring quality up to a higher standard.
- **Imitation within an industry –** domestic firms' imitate an incoming Israeli firm's production processes or organisational structure.

Although the empirical evidence for knowledge spillovers is limited (mostly due to lack of data to measure the size of these spillovers), academic papers[23,24,25,26] argue that knowledge spillovers occur more often in Digital, Telecoms and other technological sectors. The literature finds that knowledge spillovers are more likely to occur when foreign firms enter joint ventures with domestic firms (rather than enter the market as a wholly foreign owned firm) as firms with some local ownership are more likely to source inputs locally (and therefore share knowledge with a vertical supply chain) than import their inputs. In the case of Israeli tech firms undertaking FDI in the UK, knowledge spillovers have been most likely to occur following the creation of viable business opportunities on the ground in the UK. This can occur through investment (e.g. venture capital) or establishing a strategic client base in the UK (which has typically been a large UK plc).

23 Görg, H. and Greenaway, D., 2004. Much ado about nothing? Do domestic firms really benefit from foreign direct investment?. The World Bank Research Observer, 19(2), pp.171-197.

24 Görg, H. and Strobl, E., 2001. Multinational companies and productivity spillovers: A meta□analysis. The economic journal, 111(475), pp.F723-F739.

25 Kokko, A., 1996. Productivity spillovers from competition between local firms and foreign affiliates. Journal of International Development: The Journal of the Development Studies Association, 8(4), pp.517-530.

26 Smarzynska Javorcik, B., 2004. Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. American economic review, 94(3), pp.605-627.

3. The Embassy and British Council's role in supporting UK-Israel science & academic partnerships

3. The Embassy and British Council's role in supporting UK-Israel science & academic partnerships

3a) UK Science and Innovation Network and British Council programmes

The Higher Education Team at the British Council (BC) works alongside the UK's Science and Innovation Network (SIN)[27] based at the Embassy to promote UK-Israel academic and scientific collaboration. Through their work and funding programmes, the BC and SIN seek to capitalise on the strengths of both British and Israeli research institutions to jointly drive forward science and innovation and tackle some of the world's leading issues, including health, regenerative medicine, ageing, sustainability, clean growth, promotion of STEM subjects and more. Four key programmes have been funded and delivered by SIN and BC since 2012 to support scientific and academic collaboration between the UK and Israel:

BIRAX

The Britain-Israel Research and Academic Exchange partnership (BIRAX) - a £multi-million initiative of the British Council and the British Embassy in Israel, together with the Pears Foundation in collaboration with other partners[28], investing in world-leading research jointly undertaken by scientists in Britain and Israel. BIRAX started with the Regenerative Medicine Initiative and switched to Ageing in 2017.

Blavatnik Cambridge Fellowships

The Blavatnik Fellowships programme, funded by the Blavatnik Family Foundation, enables Israeli early career researchers of outstanding record to pursue their first postdoctoral research at the University of Cambridge, while fostering a scholarly exchange and greater understanding among researchers in Britain and in Israel.

SYNERGY

SYNERGY Research Mobility - is a programme that ran from 2014-2018 and connected UK and Israeli researchers via mobility, workshops and conferences in the fields of nanotechnology, neuroscience and water science.

Wohl Clean Growth Alliance

The Wohl Clean Growth Alliance an initiative funded by the Wohl Legacy, was launched in 2020 and is intended for UK and Israeli universities / research institutions undertaking projects focused on cooperation between the UK and Israel in areas of clean growth linked to food, water, and energy.

27 Further information on the UK Science and Innovation Network (SIN) is provided in Appendix C

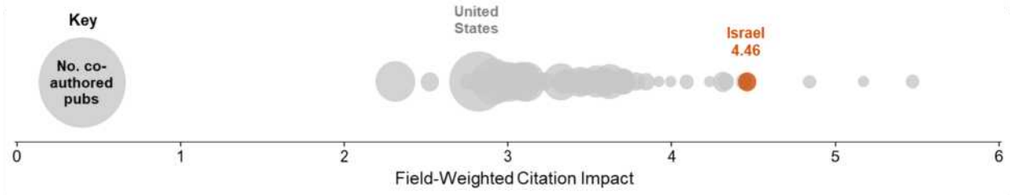
28 The Pears Foundation, Israel Ministry of Innovation, Science, and Technology, Parasol Foundation, Rosetrees Trust, Charles Wolfson Charitable Trust, Gail and Ronson Family Foundation, The Wolfson Family Charitable Trust, The Khan Foundation, The Maurice and Vivienne Wohl Philanthropic Foundation, Clore Israel Foundation, UJIA, Sheila and Denis Cohen Charitable Trust, The Barbara and Stanley Fink Foundation, Celia and Edward Atkin, Weizmann UK, UK medical charities: British Heart Foundation, Diabetes UK, JDRF, MS Society, Parkinson's UK.

These initiatives improve levels of scientific collaboration between the two countries and promote excellence in scientific research. Key outcomes achieved across each of these three funded programmes are highlighted in the following pages.

Additionally, there are a wider range of research partnerships ongoing between UK and Israeli researchers. An example of this is **Horizon 2020** which was the EU's €80 billion research and innovation funding programme from 2014-2020. In its applications for funding from this pot, UK researchers had a 15% success rate when applying for funding in collaboration with Israeli researchers (relative to average success rate of 14.4%).[29] In total, the UK and Israel worked on €500m of research projects together, and **Israel was in the UK's top five successful research partner countries.** The work of SIN and BC has indirectly supported researchers to access these wider pools of funding with at least **seven** joint applications being made by SYNERGY programme participants for EU funding via the European Research Council, Horizon 2020 and the Future and Emerging Technologies programme.

Overall, Israel is ranked 30th in terms of number of co-authored publications with the UK (with 15,172 between 2011-2020, reflecting overall publications, not just those supported by SIN and BC funding). However, when comparing the field weighted citation impact[30] of UK-Israel joint research, Israel is ranked 4th[31] with a score of 4.46 - indicating the research outputs have been cited more than 400% more times than the field averages. **This highlights the impact and significance of the research the UK and Israel undertake together in the scientific and academic community, and wider relations between the two countries.**

Figure 15: Field-weighted citation impact for the UK's top 50 research collaborators, 2011-2020



Source: PwC analysis of SciVal data for 2011-2020

29 Universities UK International, 2021 International Facts and Figures Report.

30 Field weighted citation impact, sourced from SciVal, indicates how the number of citations received by a publication compares with the average number of citations received by all other similar publications indexed in the Scopus database (Scopus is the largest global abstract and citation database of peer-reviewed literature including scientific journals, books and conference proceedings.). A Field-Weighted Citation Impact of 1.00 indicates that the publications have been cited at world average for similar publications. A Field-Weighted Citation Impact of greater than 1.00 indicates that the publications have been cited more than would be expected based on the world average for similar publications, for example a score of 1.90 means that the outputs have been cited 90% more times than expected.

31 Israel is ranked 4th amongst the top 50 countries by number of co-authored publications with the UK.

Programme 1: Britain Israel Research and Academic Exchange Partnership (BIRAX)

BIRAX is a £multi-million initiative of the British Council and the British Embassy in Israel, together with the Pears Foundation, investing in world-leading research jointly undertaken by scientists in Britain and Israel.

To date, over **£12m has been invested in BIRAX,** funding 26 research projects since 2013. With its two primary strands of research, BIRAX Regenerative Medicine Initiative and BIRAX Ageing, this represents the largest component of the BC's activities in Israel and SIN's activities to support scientific relations between the UK and Israel. Funding for projects is shared equally between UK and Israeli collaborators and projects go through a rigorous selection process.

BIRAX projects have had a significant impact on the scientific and academic communities in terms of the number of times BIRAX publications are cited in other works. From 2013 to 2020, BIRAX projects were cited a total of **8,520** times in other research papers, highlighting the wide-reaching impact of BIRAX-funded research.[34]

In addition to funding research, BIRAX provides opportunities for researchers to engage with each other's work and enable future research collaborations through conferences, workshops and promotional events. BIRAX-funded travel grants support researchers at all stages to take up fellowships, lectureship positions and symposia. A key outcome of BIRAX funding helping projects get off the ground has been the ability for them to access subsequent EU and other research funding. In many cases accessing subsequent funding would not have been possible for these researchers if the initial BIRAX support had not been provided. Case studies 5 & 6 provide further detail on how BIRAX funding has helped UK Israeli research partnerships get off the ground, and the key outcomes that have been realised (or are expected to) from the research. Section 3b and case study 6 provide an estimate of the net economic benefit to the UK related to BIRAX project's outcomes.

BIRAX programme summary

Summary stats of the BIRAX programme between 2013 and 2020:

95
publications in 72 journals

90.76
Average number of citations across all publications

10.25
Average Impact Factor per journal

4.85
Average SJR Journal Score[32]

266.02
Average H-Index per journal[33]

9.74
Average external citations per document in each journal

30.87%
Average international collaboration per paper across journals

32 SCImago Journal Rank (SJR) indicator is a measure of the scientific influence of scholarly journals that accounts for both the number of citations received by a journal and the importance or prestige of the journals where the citations come from. Higher SJR indicator values generally indicate greater journal prestige

33 The h-index is an estimate of the importance, significance, and broad impact of a scientist's cumulative research contributions. The h-index is calculated by counting the number of publications for which an author has been cited by other authors at least that same number of times.

34 PwC analysis of Google Scholar data for BIRAX publications.

Programme 2: Blavatnik Cambridge Fellowships

The Blavatnik Cambridge Fellowships, launched in 2014, offers Israeli early career researchers in the fields of life sciences, physical sciences and engineering the opportunity and funding to pursue their first postdoctoral research at the University of Cambridge.

This supports scholarly exchange, greater scientific and academic collaborations and deepening links between researchers in the UK and Israel. The programme is designed to further strengthen British-Israeli scientific relations by developing the academic capacities of Israel's brightest young scientists and creating connections that will last through their academic careers.

There is significant economic benefit to the UK of Israeli early career researchers visiting Cambridge under this programme. Analysis by London Economics[35] found that international students studying in the UK contributed approximately £103,000[36] each to the UK economy over the course of their studies. This includes expenditure on tuition and the flow on impacts (e.g. university spending on staff wages, goods and services), expenditure on housing and other living costs (and the indirect benefits associated with that spending), and expenditure from friends and family visiting (and the indirect benefits from their spending). Applying this to the Blavatnik cohorts shown in Table 3 below, an estimated £2.78m of economic activity in the UK from 2014-2022 was supported by £1.8m of BC and SIN funding for the programme. This reflects an economic multiplier of **1.53**.

Table 3: Blavatnik Cambridge Programme outcomes per year: 2014-2021

	2014-15 cohort	2015-16 cohort	2016-17 cohort	2017-18 cohort	2018-19 cohort	2019-20 cohort	2020-21 cohort	2021-22 cohort	Total	Average
# of fellows	3	3	2	3	4	4	3	5	27	3
Annual funding for the programme*	£184,250	£207,000	£119,625	£202,500	£248,100	£292,800	£248,800	£307,200	£1,810,275	£226,284
Funding per participant	£61,417	£69,000	£59,813	£67,500	£62,025	£73,200	£82,933	£61,440	-	£67,166
# of publications from Blavatnik Fellows	1	3	10	12	9	6	No data available		41	7**
# of conferences work is presented at	7	11	9	11	7	16			61	10**

* The funding includes direct payments to fellows and the Professional Development Fund.

**The 2020/21 and 2021/22 cohort figures have been excluded from the average calculations for publications and conferences as fellowships are ongoing.

35 London Economics, 2021. 'The costs and benefits of international higher education students to the UK economy.' Available here: https://londoneconomics.co.uk/blog/publication/the-costs-and-benefits-of-international-higher-education-students-to-the-uk-economy-september-2021/

36 In £ 2021 terms

Programme 3: SYNERGY research mobility

Overview:

The UK Israel SYNERGY Programme was launched by SIN and BC and operated from 2014-2018

The programme brought together researchers and scientists from the UK and Israel via conferences, symposia and travel grants

To increase the impact of the programme, it focused on key priority areas for both countries including neuroscience, nanotechnology, water sciences, and agricultural sciences, in addition to antimicrobial resistance and cyber security in its' final year

The five year programme comprised of:

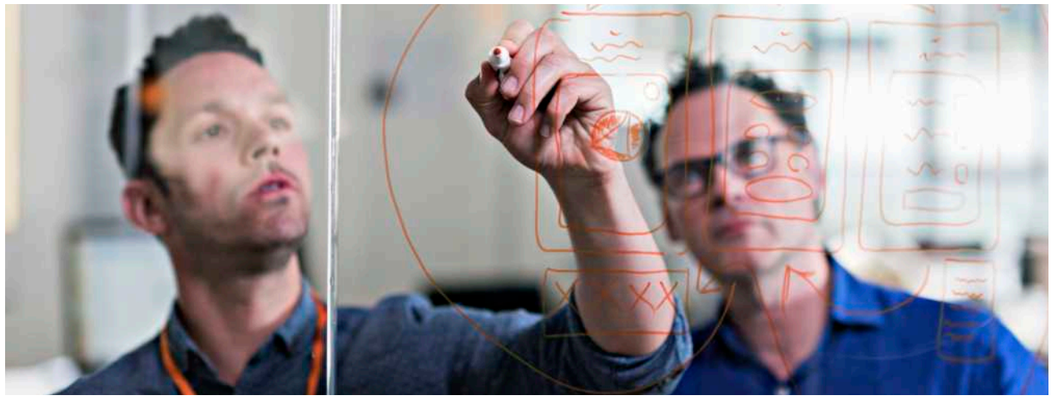
5
flagship conferences (each with a specific field of focus) with approx. 40-60 scientists attending each

30+
More than 30 symposia and workshops held in the UK or Israel

40+
More than 40 fellowships and lectureships, which enabled individual scientists from Israel to spend time at UK institutions and vice versa

Outcomes:

- The programme involved more than 850 British and Israeli researchers from more than 55 academic institutions, with many participants reporting that these visits stimulated new discussions, cultivated new research and resulted in sharing field work and the exchange of materials and techniques
- Several papers co-authored by SYNERGY programme scientists were published in a range of peer-reviewed journals such as Royal Society of Chemistry (RSC) Advances, Polymers, Restorative Neurology and Neuroscience, Materials Research Express and Physical Chemistry Letters
- Helped researchers leverage new links to application grants for greater funding, with at least **seven** joint applications being made for EU funding via the European Research Council, Horizon 2020 or the Future and Emerging Technologies programme
- Supported research areas that do not typically attract funding from commercial sources (e.g. mental health) and facilitated engagement between scientists who do not often work together due to their very specific fields of research
- In some fields (e.g. agriculture) the programme assisted researchers connect with business entrepreneurs, increasing the opportunities to plan, fund and carry out innovative science.



Funding The Wohl Clean Growth Alliance from 2021

£400,000 of funding was allocated in 2021 as part of The Wohl Clean Growth Alliance. This is part of a larger $1m fund (donated by the Wohl Legacy), intended for UK and Israeli universities / research institutions undertaking projects focused on cooperation between the UK and Israel in areas of clean growth linked to food, water, and energy. The Wohl Alliance Grants are intended to be built around the research process: to promote, facilitate, apply and/or communicate clean-growth related research (rather than fund research costs or researcher salaries directly). This programme is run in collaboration with the Israeli Ministry of Science and Technology. The $1m of funding is currently being allocated to projects, most will commence in 2022-23 and outcomes are expected to be realised from 2023 onwards.

3b) Economic impact of SIN and BC research funding

From 2012 - 2021, SIN and the BC have provided approximately **£16m** of funding across the BIRAX, Blavatnik Cambridge Fellowship and SYNERGY Programmes for research to be undertaken. This has been distributed as follows:

Table 4: SIN and BC funding opportunities for UK Israel research activities, 2012-2021

Activities supported by SIN and BC	Total funding allocated 2012-2021
BIRAX Regenerative Medicine Initiative research	£8.6m (2012-2018)
BIRAX Ageing research	£3.8m (2019-2021)
Postdoc programme (Blavatnik Cambridge Fellowships)	£1.8m (2015-2021)
Funding for UK-Israel researcher networking e.g. workshops, conferences, mobility	£1.4m (2014-2018)
Wohl Clean Growth Alliance	£0.4m[37]
TOTAL	£16m

There is a range of academic literature and economic analysis available regarding the economic benefits from funding scientific studies, academic partnerships and research and development. Table 5 opposite presents an overview of a number of economic multipliers, ranging from returns of **0.25** for spending on medical research in the UK, to **28** (over 50 years) for investment in cancer treatment research. As shown in case study 6, a conservative estimate of the multiplier effect of funding BIRAX medical research is approximately **4.7** in a single year, and **18.3** over four years.

37 Total funding for Wohl Clean Growth Alliance is $1m but only £0.4m allocated by end of 2021

Table 5: Economic multipliers of funding and investment in scientific research

Source	Economic multiplier	Approach to calculating multiplier
Grant and Buxton, 2018. 'Economic returns to medical research funding'.	**0.25**	The multiplier measures the benefits, in terms of health and GDP gains, that arise from spending on medical research in the UK.
Sussex et al, 2016. 'Quantifying the economic impact of government and charity funding of medical research on private research and development funding in the United Kingdom'.	**0.83-1.07**	The multiplier measures the additional private sector R&D spend in the UK for each £1 increase in public expenditure on research.
Blavatnik Cambridge Fellowships - Israeli early career researchers visiting the UK. See section 3a - London Economics, 2021. 'The costs and benefits of international higher education students to the UK economy.'	**1.53**	Net economic benefit of international students studying in the UK considers direct and indirect impacts of expenditure on tuition, housing and other living costs and from friends and family visiting.
BIRAX - Using a breath test to diagnose Parkinson's disease. See case study 6 for more information.	**4.7 (first year)** **18.3 (first four years)**	Estimated using data on improved diagnosis methods for Parkinson's disease and the reduced direct healthcare costs in first year post diagnosis.
London Economics, 2021. 'The economic impact of the University of Oxford'.	**5.33**	The multiplier includes the economic impact of the University of Oxford on the wider community though 5 main channels: 1. Teaching and learning 2. research and knowledge exchange 3. educational exports 4. university operating and capital expenditures 5. contribution to tourism
Chandra, A. et al, 2016. 'Returns to Society from Investment in Cancer Research and Development'.	**5 - 28**	The multipliers measure the cumulative past and future returns to society from investment in cancer treatment research. Multiplier of **5** from spending from 1973 - 1990 cumulatively by 2010. Multiplier of **28** from each $1 million invested in cancer treatment research in 2010 over a 50-year future period.
Haskel and Wallis, 2010. 'Public support for innovation, intangible investment and productivity growth in the UK market sector'.	**12.70**	The multiplier measures the marginal spillover effect of public spending on research through the UK Research Councils.

In addition to the expected economic benefits resulting from science and academic partnerships and research, BIRAX funding helps support UK economic activity through the employment of research staff. From 2013-2021 a total of 42 staff were directly employed in the UK using BIRAX funding, who in turn support economic activity in the UK sectors they purchase from.

Case study 5: BIRAX research project - Algorithms for diagnosis and management of age-related macular degeneration

Overview of the research project

Over 600,000 individuals in the UK suffer from advanced age-related macular degeneration (AMD), with a prevalence of nearly 5% for adults over 65 and 12.2% of those over 80.[38] A leading cause of vision loss in adults, it occurs when the central portion of the retina is distorted by new blood vessels leaking blood and other fluids. Treatment requires regular imaging to monitor disease progress, and frequent injections in order to preserve vision by preventing new blood vessel growth; all requiring hospital visits. Research being led by Professor Tunde Peto of Queen's University Belfast, and Professor Anat Lowenstein and Professor Dinah Zur of Tel Aviv University applies artificial intelligence and novel machine learning algorithms to large datasets of retinal scans and medical records. Introducing automated analysis of imaging into patient care has the potential to unlock large efficiency gains in the provision of treatment, while potentially improving safety and outcomes for patients.

Support provided for the project from SIN and BC

The BC provided £400,000 of grant funding for the research through the BIRAX programme, shared evenly between researchers in Britain and Israel. This BIRAX funding has been critical to getting the project off the ground. This project was made possible by the generosity of the Charles Wolfson Charitable Trust.

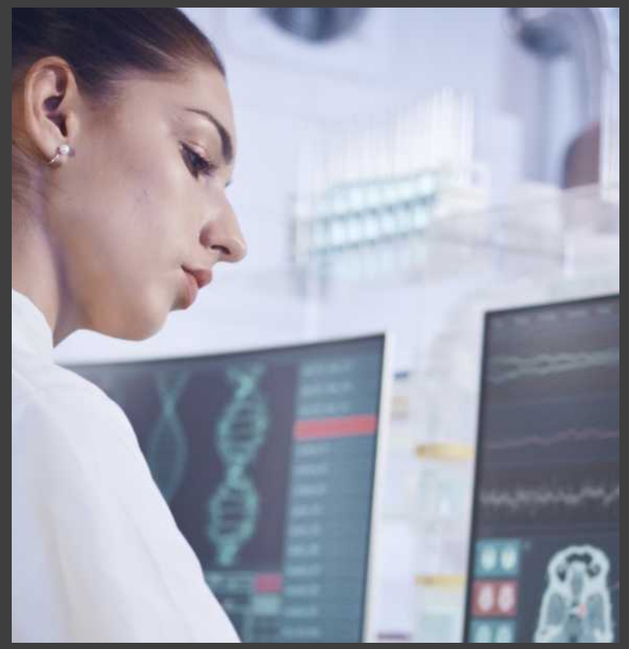
Funding from BIRAX has enabled data analysis on a much larger scale than previously expected; 2 full-time equivalent employees have been hired for 3 years across Israel and the UK, including a statistician, data scientist, project manager, and an IT specialist. This brings the necessary expertise and workforce to tackle the complex task of extracting and linking different types of data from different systems, as well as to keep the project progressing at pace. The funding directly allowed the extraction of images from the medical treatment equipment, which required an upgrading of server software.

"Without this grant, this project would not have seen light. Such a broad and long term project that it would have been very difficult to find funding that sees the importance of the project. We have not applied for anything else for this project."

Dinah Zur, Clinical Associate Professor, Tel Aviv University

"Without this funding we would probably have been able to use 10% of the data and do it very slowly ourselves. That's where a lot of healthcare research goes wrong; using convenience samples and extrapolating. So using all of the data that we have is valuable, and this has been completely enabled by the grant. We would have really struggled to make an impact (without it)."

Professor Tunde Peto, Queen's University Belfast



38 Owen et al., 2012, The estimated prevalence and incidence of late stage age related macular degeneration in the UK, British Journal of Ophthalmology, Vol. 96 (5)

Impact of the research

Although the research trials are ongoing, this project is attracting significant international attention, and research findings will be presented at the Annual Meeting of the Macula Society in June 2022 and the European Retina Specialist Meeting in September 2022. There are potentially wide-reaching implications of this research, not just for patients, but for the doctors that treat them and for individuals in other branches of medicine that rely heavily on imaging, to learn from the innovative approach to pairing image and medical record data and machine learning. With the UK's ageing population, these benefits will continue to grow.

Time saved and efficiencies: 1

- Currently physicians spend around 25 minutes per visit, 50% of which is spent analysing images. Cutting this down and having images processed and the progression of the disease monitored by sophisticated algorithms can allow doctors to see more patients safely and efficiently, by giving easy visualisations of quantitative changes over time for quick and reliable doctor evaluation.
- Both patients and those accompanying them often come in for unnecessary visits, as it is difficult for doctors to know which patients will require more regular treatment. For every 1 necessary injection, there are 1-2 visits without any treatment, and each visit takes 25 minutes. By using machine learning, researchers hope to identify patients early on that will require more regular visits and save the time of those that don't.

Safety 2

- Currently, doctors must manually analyse complex 3D retinal images in order to make decisions about treatment. The chance for human error can be minimised by introducing an automated image processing step, potentially improving patient outcomes.
- Many of those suffering from AMD are over 80 years old. With fewer visits to the hospital necessary for many patients, the chances of picking up other illnesses or infections from hospitals is reduced.

Improved health outcomes: 3

- As machine learning algorithms identify new patterns in images and arrive at novel conclusions, patient care can be better individualised, to ensure the best possible treatment is given. This has real implications for people retaining better eyesight for longer.

Spillovers from data methods: 4

- In pioneering the data extraction methods and analysing such complex datasets of 3D image and medical record data, there are potential applications for any branch of medicine that utilises imaging.
- Researchers have identified that few data analysts possess the necessary skills to conduct this analysis. Identifying this to ensure that future generations of students in AI and machine learning is crucial for making similar research and clinical methods more widely available in the future.

New data methods 5

- Big data analysis will allow risk assessment by identifying potential new biomarkers and enable individualised treatment.

Case study 6: BIRAX research project - Using a breath test to diagnose Parkinson's disease

Overview of the research project

A partnership between The University of Cambridge and Technion Israel Institute of Technology with BIRAX funding to investigate the utility of a breath test to better diagnose and track the clinical course of patients with Parkinson's disease (PD). In a study of 214 people in the UK (177 with PD and 37 controls), researchers found evidence that some chemicals exhaled in the breath could be found in patients with PD (but not controls) and seemed to correlate with disease stage. They now intend to continue to develop this system into a real-world product to be used at the point of care. Applying this type of analysis to chronic neurodegenerative disorders of the brain is a novel approach that has the potential to; (i) provide a new diagnostic test for PD as well as allow for the tracking of the disease over time using quantitative data; (ii) stratify patients into subtypes of the disease and (iii) possibly identify new information on the underlying cause behind PD.

Support provided for the project from SIN and BC

The project received £400,000 of funding from the BIRAX programme between 2015 and 2018, with 50% of the funding supported by Parkinson's UK, John Black Charitable Trust and The Parasol Foundation. This enabled the hiring of a full-time post-doctoral student, and made it possible for the researchers to compile a new and larger database of breath samples in people with PD who have been intensely characterised in the UK in terms of their clinical features and progression. This larger sample size from a country outside of Israel strengthened the robustness of the results and its ability to be used as a real-world diagnostic test that is not influenced by country- or nationality-based environments.

In addition, the international partnership nature of the programme allowed two groups of specialists who work in different areas of science (basic science and clinical science) to come together around a common problem in a new way. The original workshops and networking sessions of the BIRAX programme allowed the lead researchers to develop new areas of collaboration which were previously not considered or thought even possible. This link with Israel was crucial; no UK based researchers were utilising such technology at the time the project was launched.

> "Without the BIRAX funding, we wouldn't have done this exciting work."
> Professor Roger Barker, University of Cambridge

Impact of the research

Current clinical assessments for PD mainly use subjective clinician-based rating scales, observations and assessments with no objective biomarker that can be used robustly to diagnose and track Parkinson's. Two methods of breath analysis were tested: an 'offline' method sends collected samples to Israel for analysis, while a portable 'online' method was able to analyse the sample at the collection site.

Results showed that different aspects of PD correlated with abnormalities in the breath sample, all of which suggests that exhaled breath chemical biomarkers can successfully be used to assess PD disease states. While the offline system produced the best results, the study demonstrated that an online system (which could be used anywhere) has great potential. As a result of the findings, the researchers have started to improve the point of care system and intend to continue to extend the ability of this system in the near future with the aim of providing a real world solution for patients with PD. This research opens up the possibility of having a portable breath test available at General Practitioner surgeries in future, allowing for faster and earlier detection of PD. It could also be used in any trials of disease-modifying therapy, if its ability to accurately track disease progression can be shown in a longitudinal study of many patients. The possible benefits from this research include:

Time saved and efficiencies: 1

- The time it takes to get a diagnosis of PD can vary from person to person. Some people may receive a diagnosis quickly, but for others it may be a long process. Many people with PD have symptoms for **at least a year or two** before a diagnosis is actually made. The breath test could help save time and allow early treatment for those who need it.
- The symptoms of PD vary and overlap with other conditions, and hence PD is **misdiagnosed in approximately 20% of people**, especially in the early stages of the disease. A more accurate diagnosis using the breath test could help save time for both doctors and patients by allowing treatments and therapies to be focused accordingly.
- Reduced clinicians' time as the portable breath test means non-specialists would be able to help diagnose more people in less time.

Improved health outcomes: 2

- A definitive test for PD could help people who require treatment receive it sooner, preventing their health from deteriorating.
- Misdiagnosis can lead to unnecessary treatment being given to patients which can worsen health outcomes. A more timely and accurate diagnosis will lead to Improved quality of life for patients and their carers.
- The breath test may be able to help diagnose patients with PD ahead of them developing overt features. For example, it is known that most people (~80%) with a late onset rapid eye movement sleep behaviour disorder (RBD) convert to PD or similar condition over ~ a 15 year period. Being able to diagnose patients with RBD who are about to develop PD would be of major value in trials looking at disease modifying therapies to prevent PD.

Reduced direct healthcare costs: 3

- Misdiagnosis of PD disease means that people (and healthcare systems) can end up paying for unnecessary tests and treatment when they are not required. Table 7 shows that, if the breath test was rolled out in all UK GPs from 2023, 3,600 people that would have previously been misdiagnosed would no longer be. This is associated with direct annual cost savings of £9,195,804 resulting from reduced specialist appointments and other treatment costs that are not required.
- Living with PD is expensive. Research shows that people with PD and their families in England are on average £17,094 worse off per year as they have higher health and social care costs, lose income due to retiring early or reducing their hours, and lose out on state benefits. Using the breath test could help reduce some of these costs for those who have been falsely identified to have PD.

Table 6: Annual net benefit and economic multiplier from a roll-out of the PD breath test to all GPs in the UK

Number of people diagnosed with PD in the UK annually	18,000[39]
Percentage of PD patients that are misdiagnosed by clinicians	20%[40]
Total number of PD patients expected to be misdiagnosed in the UK in 2023	3,600
Incremental healthcare costs (consultations and medicine) in first year following diagnosis	£2,471[41] (£2,554 in 2015 terms[42])
Total annual savings from preventing misdiagnosis	£9,195,804
Less estimated annual cost of new testing system[43]	£8,259,894
Net annual benefit	£935,910
Total UK funding given to the project in 2015	£200,000
Annual multiplier benefit from BIRAX funding	**4.7**
Multiplier benefit from BIRAX funding - over four years	**18.3**

Table 6 above shows that the annual economic multiplier associated with BIRAX funding for the PD breath testing research is **4.7** - that implies that **each year** the net economic benefits of rolling out the breath test to all UK GPs would be nearly 5 times as great as the initial funding provided for this research project. Further, the economic multiplier associated with BIRAX funding for the PD breath test is **18.3 over its' first four years**. This is a conservative estimate as it only considers the direct healthcare cost savings from misdiagnosed patients not attending unnecessary appointments and taking treatment and medication they do not need.

There would likely be wider benefits associated with improved diagnosis such as:

- Clinician time saved from faster diagnosis
- Patient time saved from reduced appointments
- Productivity benefits from reduced patient time off work for fewer appointments, and increased clinician time available for other patients.

These, as well as other benefits suggest the estimated multiplier of 4.7 is a conservative estimate of the annual net economic benefits as a result of this BIRAX research project.

39 Parkinson's UK: https://www.parkinsons.org.uk/about-us/reporting-parkinsons-information-journalists

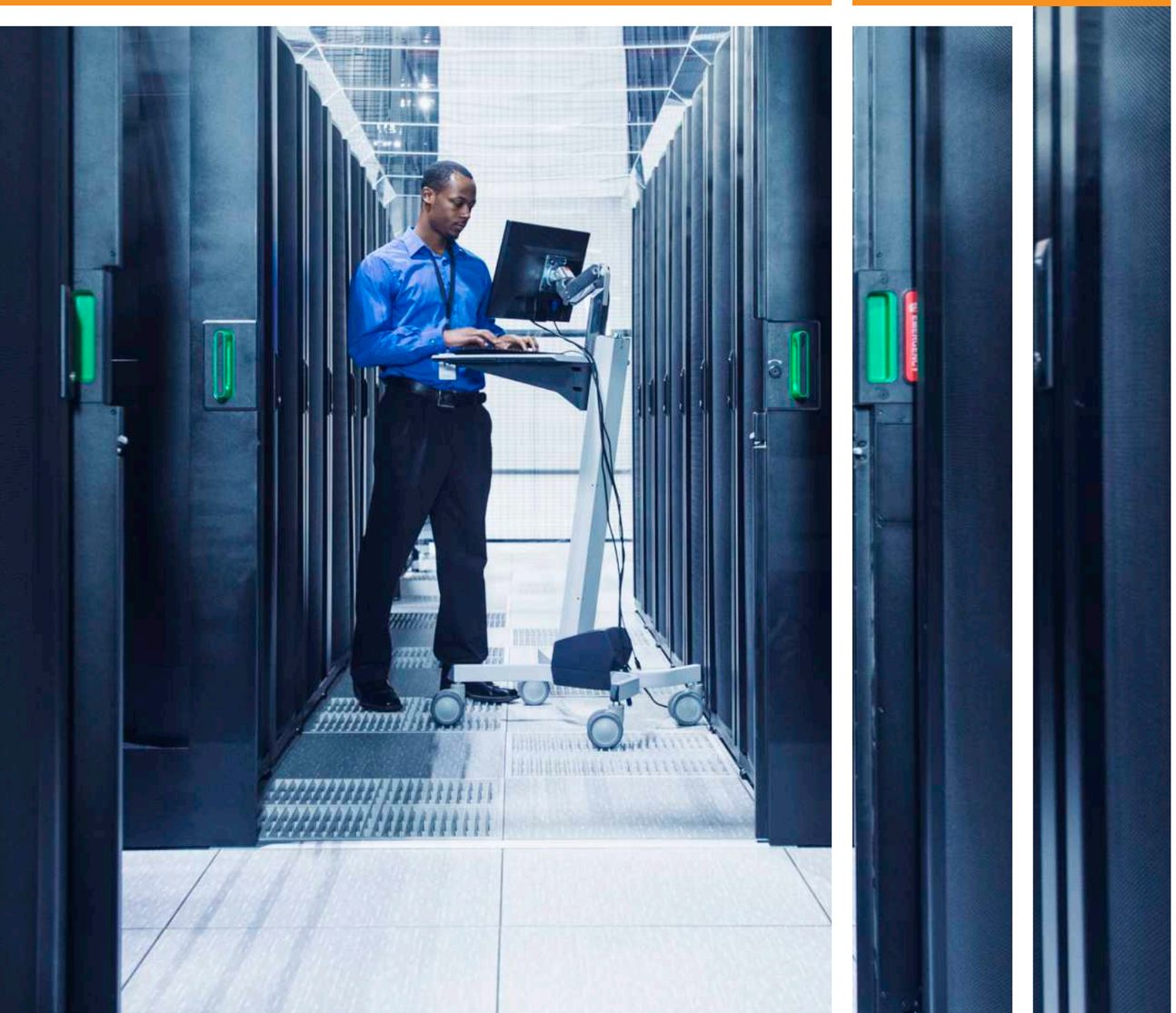
40 Professor Roger Barker, MRCP PhD

41 Weir et al. 'Short- and long-term cost and utilization of health care resources in Parkinson's disease in the UK. Movement Disorders. First published: 30 March 2018 https://doi.org/10.1002/mds.27302. The figure is obtained from the difference between the direct healthcare costs (hospital visits and medications) in the first year following diagnosis for patients with PD and those with no Parkinson's.

42 Inflated to 2015 terms (same year £200,000 funding was allocated) using the Bank of England inflation calculator https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator

43 PwC analysis of cost to roll out online breath testing system to all UK GPs and administer test to all new patients who experience tremors (common early PD symptom).

4. The outlook for UK-Israeli trade and research partnerships



4. The outlook for UK-Israeli trade and research partnerships

This report has captured how recent years have seen significant growth in the economic and scientific relationships between the UK and Israel. Looking forward it is clear there is potential to significantly deepen these ties through the following activities led by the Embassy:

UK Venture Capital (VC) investment into Israel:
UK based VCs have significantly increased their investment in Israeli startups over the last 10 years, including during the pandemic. From 2011 to 2021, a total of 53 UK VCs had invested in Israel[44] holding a total of 218 Israeli investments between them. This activity is strengthening the trade, investment and innovation relationships, particularly as UK VCs are likely to encourage Israeli startups to set up international operations in the UK (instead of other countries in the EU and further afield), which in turn supports employment and economic growth in the UK.

Israeli VC investment into the UK:
Israeli VCs are also increasingly investing in UK start-ups, which is providing critical early stage funding for UK start-ups to grow. From 2011 to 2021 Israeli VCs completed approximately £1.6bn of deals with UK companies. Nearly 50% of this was investment in information technology, but other key sectors include financial services, consumer products and services and health. 2021 was the strongest year in the past 10 years for Israeli VC investment in the UK, with a total deal value of £438m. 2018 was the second highest year with a total deal value of £377m. This has grown from a baseline of £6.29m of deal activity in 2011, representing a 69 times increase in deal value from 2011 to 2021.

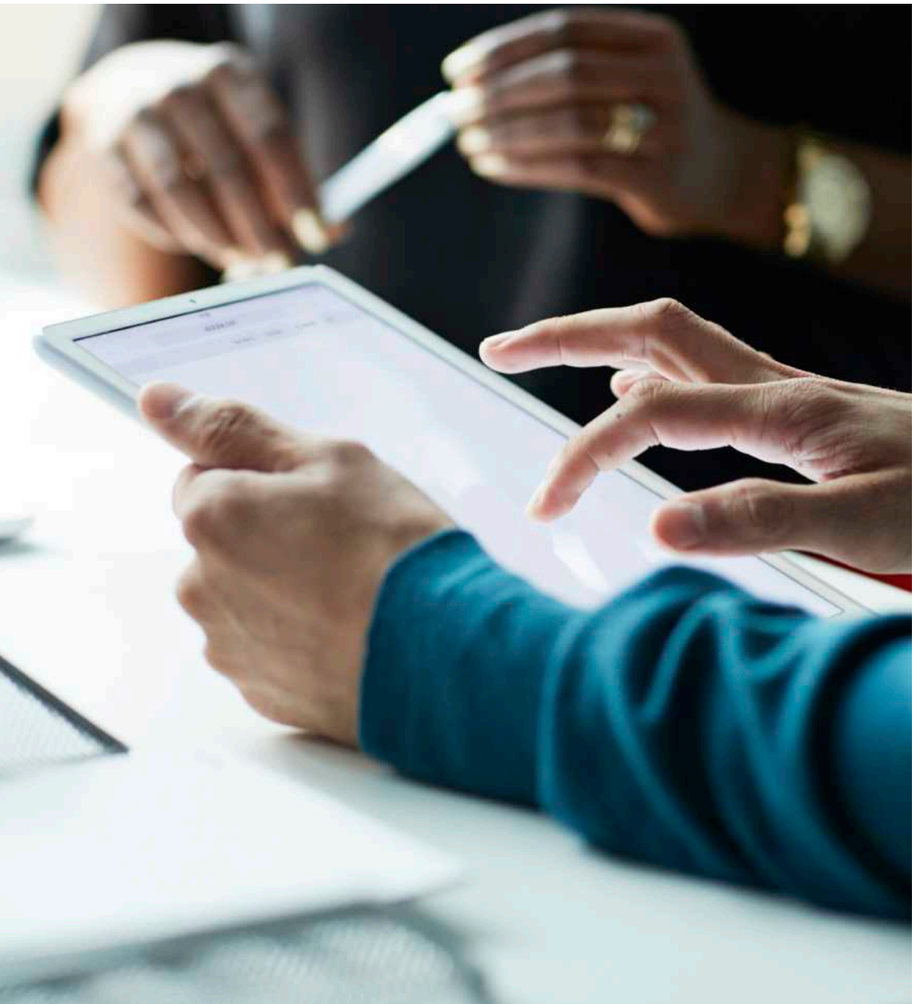
Tech access:
Through increasing exposure of Israeli tech startups to UK businesses (including those with operations on the ground in Israel), there is an increased likelihood of Israeli startups gaining an “anchor” or significant UK customer. Having an “anchor” UK customer is a similar relationship to the pull UK VCs have on encouraging Israeli tech firms to expand and set up operations in the UK (see section 2a), which supports inward FDI into the UK. UKITH has worked closely with NatWest Group since 2015 to help connect them with cutting edge Israeli cyber security, fintech and customer personalisation tech that has been successfully adopted in their business. Going forward, NatWest Group plans to use its relationships with UKITH to connect its UK business customers with the Israeli tech ecosystem to help their clients improve business efficiency and operations. Building on relationships made in the 10 years since the UKITH was launched, going forward a continued rise in the adoption of Israeli tech in UK businesses should be expected.

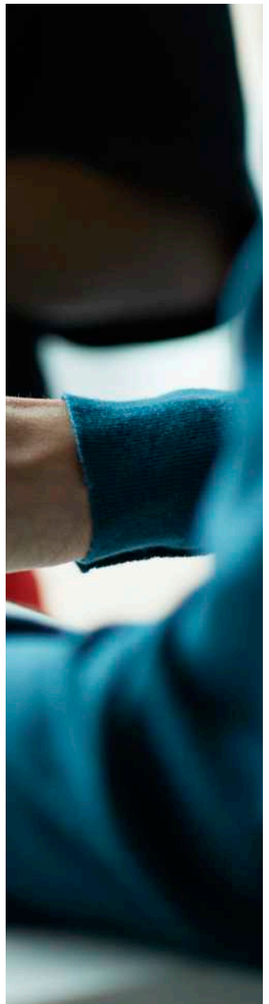
UK - Israel Tech Gateway:
Similar schemes to the Leeds-Israel Health Tech corridor will be developed over the coming years, including regional and sector-based alliances aimed at Industry 4.0 & smart mobility and fintech. Supporting these alliances with dedicated services as well as utilising both Israeli government incentives and UK performance-based incentives, will create a substantial draw for high-growth Israeli companies to come to the UK and set up substantial operations, providing UK-based companies with cutting-edge innovation and tying into the regional levelling-up agenda.

Long term funding commitments for science and academic partnerships:
Key to continuing relationships and research partnerships between the UK and Israel is securing a more longstanding / permanent funding commitment for joint projects. Anecdotal evidence following the completion of a number of BIRAX projects is that due to funding availability, many projects have pivoted their focus to the US and other markets, resulting in more benefits accruing outside the UK than in it. To help attract and maintain research partnerships between UK and Israel institutions, the UK and Israeli Governments as well as other research funding bodies should consider scope for a long term funding commitment to be made. Programmes with a long term vision and funding commitments would also allow for further impact evaluation to be undertaken.

44 Source: PwC analysis of Pitchbook data. Note this only includes VCs that started investing in Israel from 2011 onwards. There may be additional UK VCs that begun investing in Israel prior to 2011 and continue.

Appendices





Appendix A: Overview of the British Embassy in Tel Aviv (BETA)

The British Embassy Israel was established in Tel Aviv with the objective of maintaining and developing relations between the UK and Israel, and providing consular support to UK citizens in Israel. The scope of work covered at the Embassy includes political, commercial, security and economic questions of interest to both the UK and Israel.

UK Government Departments and organisations operating as part of the Embassy

The organisations based there help oversee UK-Israel trade worth billions of dollars annually, support hundreds of companies and startups from both countries, and fund numerous bilateral research initiatives:

Department for International Trade

1. Department for International Trade

- Identifies business opportunities in the UK (the world's fifth largest economy) for Israeli investors
- Promotes British products and services in Israel
- Supports Israeli businesses to expand to the UK, including advising on legal and regulatory requirements

UK Israel Tech HUB

2. UK Israel Tech Hub:

- Part of DCMS' International Tech Hub Network (see Appendix B)
- Identifies innovative technologies and products in Israel to support UK businesses, including hosting delegations of UK businesses to Israel and vice versa
- Supports Israeli startups to expand operations to the UK
- Shares best practices with key innovation players within Israel's tech ecosystem

UK Science & Innovation Network

3. Science and Innovation Network (see Appendix C):

- Aids involvement in joint UK-Israel research programmes
- Aids joining science activities with the top scientific institutions in the UK and Israel

Additionally, the Embassy works closely with other UK organisations operating in Israel, including the British Council in Israel (see report section 3a).

British Embassy Tel Aviv (BETA) Leadership

British Ambassador to Israel, Neil Wigan OBE

- Appointed Her Majesty's Ambassador to the State of Israel in June 2019
- As Ambassador, he is responsible for the direction and work of the Embassy, including political work, trade and investment, press and cultural relations, and visa and consular services

Deputy Head of Mission, Alice Truman

- Joined the Embassy in May 2019 and appointed Deputy Head of Mission in May 2022.
- As Deputy, she is responsible for the daily management of the Embassy and will represent the UK's interests in the absence of the Ambassador as Chargé d'Affaires

In addition to BETA, this study has been undertaken with the support of the British Council in Israel (BC).

BRITISH COUNCIL

British Council in Israel (BC)

- The British Council builds connections, understanding and trust between people in the UK and other countries through arts and culture, education and the English language.
- The Israel office promotes higher education and academic collaboration between the UK and Israel
- Develops, operates and drives forward science and innovation on some of the world's leading health and environmental challenges as well as mobility programmes

Appendix B: DCMS' International Tech Hub Network (ITHN)

Overview of the DCMS International Tech Hub Network and key activities undertaken

The DCMS' International Tech Hub Network (ITHN) works to forge innovation partnerships between the UK and international tech sectors, stimulate local digital economies, and build high-end digital skills to drive sustainable jobs and growth. Following the success of the original UK-Israel Tech Hub, the Network has expanded its reach across the globe under the FCDO-led Digital Access Programme (DAP).

Over the last two years, these ODA-funded Hubs have launched a range of projects to strengthen their local ecosystems, promote digital inclusion, and champion impact-driven startups. The network delivers projects such as the Future Females Business School, African Angels Academy and Go Global, which bring together tech innovators from across the world to share innovation, facilitating global partnerships. Thousands of entrepreneurs have benefitted from training, mentoring, and networking by participating in these programmes.

In 2020, the Hubs rapidly pivoted their focus to pandemic response, allowing continued support of innovative startups and individuals as they aimed to develop and expand internationally.

Other countries with tech hubs (or similar tech-driven partnerships) in Israel

The Israel Innovation Authority has formed joint-innovation partnerships with countries across the globe. In the Americas, Israel has a strong relationship in science and technology with Canada. The Government of Canada has partnered with Israel to support joint research, development and commercialization projects. The governments of Ontario and Quebec have also established programmes to support companies and researchers pursuing partnerships with Israel.

European countries and Israel have a history of successful and groundbreaking technological and scientific cooperation in a number of fields – much of which is a result of the many bilateral cooperation agreements between Israel and European countries, along with Israel's membership in a number of multinational programmes for collaboration in industrial R&D. Europe is to date Israel's main partner for collaborative industrial R&D projects, allowing Israeli companies to access know-how, R&D infrastructure and world markets together with European partners.

Israel also has bilateral agreements with APAC countries in science and technology. For example, a MoU signed between India and Israel in 2017, with a contribution of $20 million from each side over 5 years, is playing an important role in enabling Indian and Israeli enterprises to undertake joint R&D projects. More than ten R&D projects, including the Apollo-Zebra Medical Artificial Intelligence-based project for the early detection of tuberculosis, have been funded through this programme.

Other DCMS ITHN countries

Country Year Founded	**Outcomes**
Kenya 2019	• Over 1000 startups and SMEs have been supported and a total of 22 projects delivered • Launched the Business Regulatory Toolkit website to aid small businesses navigate regulations in Kenya
Nigeria 2019	• Impacted over 2,500 startups from across 15 Nigerian states, of which 600 have benefitted from C19 response programmes • More than 200 young Nigerians have received capacity-building and digital skills training, and another 230+ women have received mentoring and business support
South Africa 2019	• 13,000+ beneficiaries – the majority of which were women – have been trained via 550 training sessions. • Almost 9,000 beneficiaries have been networked into the local tech ecosystem, and another 41 South African entrepreneurs have been tangibly connected to the UK market. • 184 new digital businesses or innovations have been created, and 4 startups have successfully expanded to the UK, with a combined company value of £12.2m.
Indonesia 2020	• Boosted digital literacy skills of more than 150 female entrepreneurs through the HERFuture programme • Delivered the Tech to Empower programme which supported 100 people with disabilities to become digitally-ready entrepreneurs through virtual skills training • Tech to Impact programme successfully reached over 3,000 participants and facilitated 42 startups pitching to investor panels
Brazil 2021	• 200 women entrepreneurs supported through the Future Females Business School programme • Over 200 tech solutions for development challenges created • Improved access to global markets for Brazilian female entrepreneurs

Future outlook

The established Hubs' expert teams will continue to deliver pioneering programmes and activities catering to local needs, as well as engaging with startup policy in their respective countries. Given the immense potential of the successful pilot projects of the respective Hubs as well as cross-network activities, DCMS aims to deepen impact in the Hub countries and create further linkages and collaboration on a local and network-wide level.

Appendix C: UK Science and Innovation Network (SIN) in Israel

Overview of the UK Science and Innovation Network

To promote international collaboration on Science and Innovation, the Department for Business, Energy & Industrial Strategy (BEIS) and the Foreign & Commonwealth Development Office (FCDO) jointly fund the UK Science and Innovation Network (SIN). The Science and Innovation Network (SIN) has approximately 100 officers in over 40 countries and territories globally building partnerships and collaborations on science and innovation. SIN officers work with the local science and innovation community in support of UK policy overseas, leading to mutual benefits to the UK and the host country.

UK SIN activity in Israel

In Israel, SIN works with the local science and innovation community in support of UK policy overseas, leading to mutual benefits to the UK and Israel. The priorities for UK engagement with Israel are set by the UK-Israel Science Council, a group of 25 leading scientists and policymakers from both countries, whose core mandate is to improve collaboration in science between the two countries. The Council and the Bilateral Memorandum of Understanding on Science between the UK and Israel identify these science priorities as Nanoscience, Neuroscience; Regenerative Medicine, Agrisciences and Water Science. Both countries also agreed to focus on researcher mobility and regional collaboration as additional mechanisms to pursue excellence in joint science and research.

Some of the key initiatives undertaken by UK SIN in Israel currently include:

1. **BIRAX (Britain Israel Research and Academic eXchange)** is an initiative of the British Embassy and the British Council in Israel. Since 2013, BIRAX has raised £13m dedicated to 26 collaborative research projects in the fields of Regenerative Medicine and Ageing. BIRAX funded projects have led to FDA approved diagnostics, researchers winning the Israel Prize and cutting edge progress in therapy for Diabetes and Neurodegenerative disease. For further details see chapter 3 of this report.
2. **Innovation MoU** delivered by the IIA (Israel Innovation Authority) & UKRI (United Kingdom Research and Innovation) which is a £4 million multi-year bilateral programme to support business-led R&D collaboration between Israel and the UK.
3. **Science & Technology MoU** focused on creating policy dialogue on research, science and community activities. The research is linked to AI, water, agri-tech, food security, bio-technology, renewable energy, cybersecurity, advanced materials (including nanomaterials) and health.
4. **Cross-border programmes** such as the STREAM programme which supports trilateral water research projects between the UK, Israel and a neighbouring country (Jordan, West Bank, Gaza, Morocco), and the GROWTH Fellowships Scheme which supports Palestinian graduates pursuing PhDs in Israel.
5. **Wohl Clean Growth Alliance** is a new initiative funded by the Wohl Legacy that aims to further research-related collaborations around water, food and energy. For further details see chapter 3 of this report.

Outcomes and benefits of UK SIN's recent work in Israel

The majority of UK-Israel collaborative research can be viewed in 3 main clusters:

34% **Medicine, Biochemistry, Genetics and Molecular Biology**

13% **Computer Science, Engineering and Mathematics**

13% **Physics and Astronomy**

Key statistics regarding the outcomes of UK-Israel research include:

- UK-Israel collaborative research is three times more likely to be cited than unilateral research by either.
- Israel is the UK's top collaborator in the Middle East (measured by co-authored publications) and the UK represents Israel's top collaborator after the US in Medicine (with a higher collaborative citation index over 7), and 3rd collaborator overall.

The Blavatnik Cambridge Fellowship, since being founded in 2014, has resulted in 22 Israel scientists pursuing fellowships at the Cambridge University, leading to 40+ joint UK-Israel authored publications being released during their fellowship programmes. See chapter 3 for more details.

SIN Israel also organised the first UK-Israel Dementia Symposium, with outcomes including an Israeli pharmaceutical company committing $1 million for early stage work on dementia in UK academic and medical centres.

Appendix D: Overview of Foreign Direct Investment (FDI)

Definition of FDI

Foreign direct investment (FDI) is a category of investment that reflects the objective of establishing a lasting interest by a resident enterprise in one economy (direct investor) in an enterprise (direct investment enterprise) that is resident in an economy other than that of the direct investor. The lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence on the management of the enterprise. The direct or indirect ownership of 10% or more of the voting power of an enterprise resident in one economy by an investor resident in another economy is evidence of such a relationship.

The definition outlined above, which classifies FDI as requiring 10% or more of the voting power (e.g. through share ownership), aligns with definitions of FDI used by the UN, ONS and other UK government and international organisations.[45,46]

Drivers of FDI

There is much research surrounding the key drivers of FDI into a country. Nielsen et al[47] consider the key drivers of a firm's decision to undertake FDI in a host country include:

Quality of infrastructure	Quality of human capital
Tax incentives (including low corporate tax rate or specific tax concessions)	Special economic zones (SEZ)
High concentration of firms in a specific industry (clustering)	Location characterised as a "global city"
High number of firms in a particular location	Low congestion costs
High concentration of foreign firms	Individual firm has experience in FDI host location
High concentration of firms from a specific home country	Formal institutions (i.e. political stability)

Types of spillovers from FDI

Depending on the nature and type of FDI, there may also be positive spillovers to other firms and sectors from inward FDI. FDI that delivers positive spillovers may be seen as effective FDI, as spillovers can help to build local knowledge, skills, capabilities and technologies. The literature identifies two main categories of FDI spillovers:

1. Pecuniary spillovers are spillovers from FDI in the form of induced supply chain activities and greater employee spending.

2. Non-pecuniary spillovers are non-financial spillovers, including knowledge spillovers. These occur when the activities of multinational enterprises affect the technological endowment of local firms, either vertically (within an industry via supply chain) or horizontally (across industries). Knowledge spillovers are most likely to occur in joint foreign-domestic collaborations and in the technology (Digital, Telecoms) sector, and there is limited evidence available of non-pecuniary spillovers from fully foreign-owned investments or into other sectors.

45 Investment Division, Directorate for Financial and Enterprise Affairs, OECD Glossary of Foreign Direct Investment Terms and Definitions, Organisation for Economic Co-operation and Development. Available from: https://www.oecd.org/daf/inv/investment-policy/2487495.pdf.

46 In their latest release, the ONS notes that "FDI is also defined by control relationships, where the direct investor (parent company) controls atleast 10% of the voting power (ordinary shares) of the direct investment enterprise " Office for National Statistics, February 2022. Foreign direct investment involving UK companies: 2020. Available from: https://www.ons.gov.uk/economy.

47 Nielsen, B.B., Asmussen, C.G. and Weatherall, C.D., 2017. The location choice of foreign direct investments: Empirical evidence and methodological challenges. Journal of World Business, 52(1), pp.62-82.

Risks to inward FDI in the UK

There are some specific risks to FDI in the UK as outlined below:

- **Unfavourable tax environment:** A less favourable tax rate may deter foreign investors due to the cost of doing business, particularly relative to incentives offered by other countries. This may include increases in the corporate tax rate, or lack of tax incentives to attract foreign firms to specific industries.
- **Insufficient or poor quality infrastructure:** In some sectors there may be particular infrastructure and physical environment required to attract foreign investors, such as concert halls and theatres for the music industry, telecommunications infrastructure or purpose built clusters (e.g. media cities). If this infrastructure is not in place, foreign investors may not be willing to invest.
- **Complex business and/or legal processes:** If undertaking FDI in a particular location includes complex legal and logistical challenges, this may be a deterrent for foreign investors due to potential costs and time required to understand and navigate the processes.
- **Uncertainty over the shape of the future trade arrangements** between the UK, EU and other markets would also likely affect investor confidence, and therefore inward FDI.

Policy tools to stimulate inward FDI in the UK

A range of policy tools are used by governments around the world to address the above challenges and induce inward FDI. These policy tools include:

- **Tax incentives** and **Special/Free Economic Zones** to address risks of an unfavourable tax environment
- **Investor support agencies** to address frisk of complex business and legal processes
- **Skills and human capital** e.g. training and education in digital sectors to ensure the labour market meets the needs of MNEs
- **Infrastructure** e.g. telecommunications, transport, purpose built clusters (such as media cities) to attract foreign firms

Some of these have already been implemented or are planned to be introduced in the UK.

Appendix E: Data, Input-Output modelling methodology and additional results

This section provides a detailed description of the potential and chosen data inputs to the input-output modelling, the input-output methodology, how it is used to estimate the economic impact of Israeli FDI into the UK, and some additional results that were not included in the main report.

Data

Input-output analysis framework is used to estimate the impact of FDI on the UK economy in terms of Gross Value Added ("GVA") and employment. In order to disaggregate this impact across sectors, data on the inward FDI flows (or stocks) from Israel to the UK is required, broken down by sector of the receiving business. There were multiple possible data sources considered:

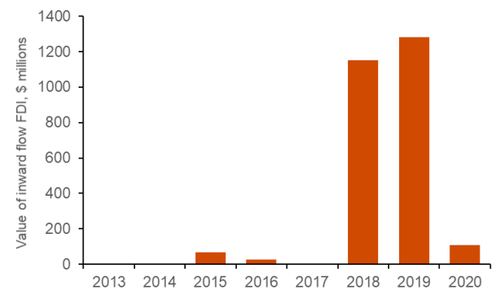
1. Office of National Statistics (ONS)

Most ONS data on inward FDI is broken down by either country of origin or sector, not both. Further, the primary issue with all ONS data sourced is that data disclosure rules prevent the publishing of detailed FDI data from Israel.[48] As a result, even top level data on inward FDI from Israel was obscured, and any further breakdowns by sector were also unavailable.

2. Organisation for Economic Cooperation and Development (OECD)

For many countries, OECD offers data on inward FDI from industry. However, for investments between the UK and Israel, this data is only available at a whole economy level (no sector breakdown), and has several missing years. Figure 16 shows that the years 2013, 2014 and 2017 are missing due to data disclosure issues, while the differences between 2015-16 and 2018-19 suggest that this data may not be complete even for years it is available.

Figure 16: OECD data on total inward FDI flows from Israel, 2013-2020



Source: PwC analysis of OECD data

Due to the incomplete time series, and lac of sector breakdown, this data was not suitable for the input-output modelling.

3. International Trade Centre (ITC)

ITC provides FDI statistics for sets of countries broken down by sectors. For Israel, the total FDI data is limited (unavailable for 2013-14) and the breakdown by sector only considers a few high level sectors and seems to underestimate the FDI in those and other sectors, given what projects the Embassy have assisted over the period. Further, for the years 2018-19, there is no breakdown by sector. The ITC data is presented in Table 7 below:

Table 7: International Trade Centre data on inward FDI flows from Israel to the UK, 2013-201

Sector	2013	2014	2015	2016	2017	2018	2019
Total	0	0	68.57	25.35	133.53	1154.38	1280.23
Unspecified Total	-71.85	-26.44	9.1	0.55	112.52	0	0
Secondary Sector	87.52	0	5.55	-7.97	3.95	0	0
Manufacture of computer, electronic and optical products	0	0	0.11	-1.77	3.95	0	0
Tertiary Sector	-15.67	26.44	53.92	32.76	17.06	0	
Wholesale and retail trade	-1.59	11.56	-0.22	1.55	6.89	0	0
Transport and storage	0	0	1.89	3.1	0.23	0	0
Financial and insurance activities	0	0	30.51	29.33	-3.39	0	0
Professional, scientific and technical activities	6.24	14.88	22.86	0.11	-3.84	0	0

Sources: PwC analysis of ITC data. Note: Negative values indicate disinvestment from Israel to UK (i.e. removal of FDI).

48 For example, see the Israel Trade and Investment Factsheet, page 10, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1060961/israel-trade-and-investment-factsheet-2022-03-18.pdf

4. Survey data from British Embassy Tel Aviv

As part of their role helping companies that are looking to invest in the UK, the Embassy has had contact with many Israeli companies that have made investments. The Embassy surveys each company they help make an investment, collecting data on the overall size of the investment and the expected number of jobs that will be created.

The resulting dataset provided by the Embassy consists of the total FDI into the UK from Israel per year, the number of jobs expected to be created, and the companies that made those investments. It was further necessary to break down the total inward FDI flow into UK sectors. To do this, companies were matched in each year's list to the Companies House registry of companies in order to find which Standard Industrial Classification (SIC) code that business operated in.

On the assumption that larger companies would invest more, the total FDI was apportioned for each year across the companies, by revenue. To do this, data on company revenue and number of employees from the FAME database (which is sourced from accounts data on Companies House) was used.The three primary assumptions made in obtaining a dataset of inward FDI from Israel to the UK by sector:

1. Larger companies (measured by UK revenue) would invest more into the UK. The drawback is that companies that are making an initial investment, with the expectation of high revenue in several years, may be understated in the sector split.
2. Companies that only report employee data have revenue data imputed using the average revenue per employee for other companies in their industry. Some companies only had data on the number of employees and not on revenue. Here, revenue was imputed by using the average revenue per employee for companies in the same industry. If no companies in that industry were present in the dataset with full data, the average of all industries was used.
3. Companies that do not file revenue data are too small to impact the overall sector split. In the UK, companies can file 'small company accounts' or 'micro-entity accounts' if they do not exceed a certain threshold. In both of these types of accounts, revenue data is often not available on Companies House. For small (micro) accounts, a company must meet any 2 of the following:
    a. Turnover of £10.2 million (£632,000) or less
    b. £5.1 million (£316,000) or less on its balance sheet
    c. 50 (10) employees or less

Companies that did not provide data on either revenue or number of employees dropped out of the dataset, and were assumed not to have impacted the sector split of FDI.

It is important to note that no inward FDI was excluded; just that the sector of these companies without data does not factor into the apportionment. If it is assumed that excluded companies have the same sector breakdown as included companies, then companies dropping out due to lack of data would have no effect on the final FDI apportionment by sector.

Further, this data includes no information about the years over which each investment is made. It is assumed the total of each investment was made in the financial year specified. Additionally, the Embassy's survey dataset includes no information about FDI disinvestments into the UK.

The company-level dataset of FDI is not presented here, due to confidentiality, but the final dataset on total inward FDI flows from Israel to the UK, including a sector split, are presented in Figures 13 and 14 in Chapter 2c.

The data outlined above on the value of inwards FDI from Israel to the UK form the inputs into the IO analysis. The next section details how input-output tables work, and how they are used in this study.

Input-Output Tables

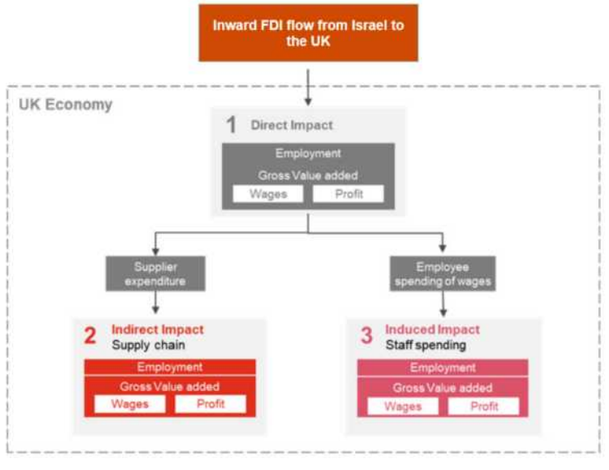
An input-output ("IO") table is a representation of a country's economy, and provides an overview of the transactions between the different sectors of the economy. In particular, for a given sector, it gives the number of units of input needed from different sectors to produce one unit of output. This demonstrates how production in a sector stimulates production elsewhere in the economy.

The process of spending in one sector stimulating economic activity in other sectors is called the *multiplier effect*. As illustrated below, this is done through two channels: a) supply chain spend; and b) employee spend.

The analysis assumes that the total value of the FDI is spent on material investments, distributed across sectors as given by the Gross Fixed Capital Formation Table in the UK Supply and Use Tables published by the ONS. This assumption of FDI being capital investment spending is made due to lack of data on the split between operating and capital expenditure in our dataset, and simplifies the analysis; it is likely that the most substantial spending following FDI would be on capital. Therefore, the initial FDI inflow into each industry is split out, by the industries that those companies would spend on in capital investments.

The analysis does reflect the fact that some of this investment spending would go to imports, and thus the associated benefits down this supply chain do not accrue to the UK. The proportion of imports is taken from the total GFCF table, and the same proportion is applied to all industries.

Figure 17: Economic impact of FDI into the UK economy through direct, indirect and induced channels



1. **Direct Contribution:** This is created directly as a result of FDI into a given sector in the UK.
2. **Contribution through supply chain spend:** This is generated along a typical company's supply chain through the procurement of inputs from the rest of the economy. Since the typical input requirements for production in each sector can be traced through an IO table, the total value of production stimulated in the economy per unit of output produced in each sector can be calculated.
3. **Contribution from employee spend:** This is generated through the spending of wages by employees throughout the value chain. An IO table is used to understand how employees (proxied by the household sector) spend their household income on different sectors in the economy. Similar to the process of mapping contribution through the supply chain, how this spending stimulates additional production in the sectors households purchase goods from is mapped out.

IO tables are used for this study to calculate multipliers that allow estimation of the additional contribution created by spending throughout the data value chain, and through the spending of employees in this value chain. Gross value added ("GVA") and employment (measured by number of full-time jobs) are used as the indicators for measuring the contribution of FDI in different UK Sectors.

To calculate these contributions, the following key variables are constructed for every sector in the UK's IO tables prepared by the ONS:

- **Household consumption coefficients:** These refer to the proportion of the household income that is spent on different sectors in the economy. For any given sector, these are calculated by dividing the household consumption demand of that sector by the UK's average annual household income. This value was calculated for each year of analysis, and adjusted by a composite adjustment factor made up of a labour productivity time series and the GDP deflator.
- **GVA to output ratio and employment to output ratio:** For any given sector, the GVA to output ratio refers to the direct GVA created per pound of output produced in the sector. This is calculated by dividing the direct GVA of a sector with its total output. Similarly, the employment to output ratio is calculated by dividing the number of employees in a sector with its total output.
- **Employment and GVA multipliers:** For any given sector, the multiplier is calculated that gives the additional GVA generated in the economy (per extra £ of direct GVA produced in that sector) as a sector's supply chain is stimulated and as the employees in the sector and along its supply chain spend their income. This gives the total increase in GVA accounting for effects of supply chain spend and employee spend. The equivalent ratio is calculated to form the employment multiplier.

The graphic below illustrates the formula for the GVA multiplier:

These ratios allow the estimation of each of the contributions to the UK from a £ of FDI in a given Sector by making the following calculations:

Direct Contribution: To find the direct contribution of a given quantity of FDI-induced investment spending in a sector on employment and GVA, the total investment is multiplied by the sector's GVA to output ratio and employment to output ratios respectively. This gives the amount of direct GVA and direct employment created, and forms the first part of the contribution through supply chain spending.

Indirect Contribution: To find the contribution of a quantity of GVA through the supply chain, the direct GVA generated from the FDI (calculated above) is multiplied by the 'L1' multiplier for that sector. The 'L1' multiplier is calculated from a given industry's spending per unit of output, derived from the IO Table. The equivalent calculation is performed to calculate the indirect impact to employment.

Induced Contribution: To find the contribution created by employee spending effects, the multipliers are applied that capture the employee spending effects to the direct GVA and employment calculated.

Following the previous example, if the Agricultural Sector's GVA multiplier for employee spending is 0.6, and given that direct GVA from £10m of FDI is £4m, then the Agricultural Sector is responsible for generating additional GVA through employee spending effects equal to £4m * 0.6 = £2.4m.

In this example, the total contribution to GVA from the £10m FDI in the Agricultural Sector is £4m (direct contribution) + £6m (indirect contribution) + £2.4m (induced contribution) = £12.4m (total GVA contribution).

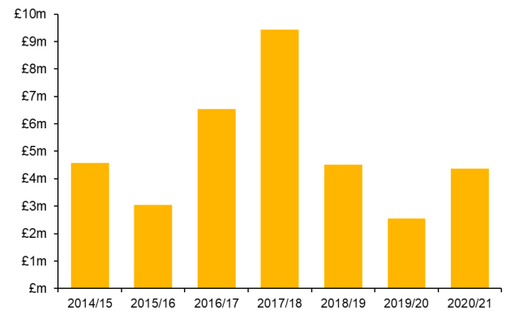
Figure 18: Calculation for the GVA multiplier

Additional Results

Below are some additional results from the IO modelling that are not included in the main body of the report.

Average GVA per investment: Accounting for the number of transactions made in each financial year, Figure 19 shows how the average GVA impact per FDI investment has changed per year. Note that the analysis assumes that FDI apportioned to a given financial year in our dataset takes place fully in that financial year. The fairly consistent number of investments per year implies that the average impact was highest in 2017/18 at almost £9.5m per FDI investment. This metric is showing signs of recovery post-pandemic.

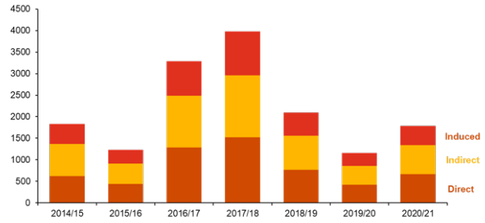
Figure 19: Average GVA per FDI investment from Israel to the UK, per year, 2014-2022



Source: PwC analysis of BETA data

Annual employment impact from FDI: The shape across the years of the employment impact on the UK is similar to that of the GVA impact of FDI, similarly with the average employment supported per investment. The average number of jobs (direct, indirect and induced) supported per investment is 29 for 2014-2021.

Figure 20: Total employment impact of UK inward FDI from Israel, per year, by impact channel



Source: PwC analysis of BETA data

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