



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Smart specialization

Citation for published version:

Shilon, M, Kaufmann, D, Schwartz, D & Rosiello, A 2021, 'Smart specialization: A spontaneous four-step process in the mixed Arab-Jewish Region of Haifa and Nazareth', *Regional Studies*.
<https://doi.org/10.1080/00343404.2021.1948524>

Digital Object Identifier (DOI):

[10.1080/00343404.2021.1948524](https://doi.org/10.1080/00343404.2021.1948524)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Publisher's PDF, also known as Version of record

Published In:

Regional Studies

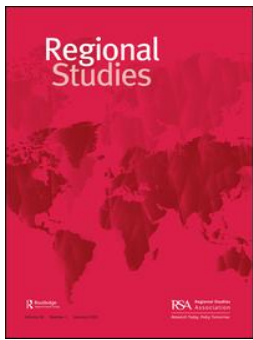
General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.





Smart specialization: a spontaneous four-step process in the mixed Arab–Jewish region of Haifa and Nazareth

Mor Shilon, Dan Kaufmann, Dafna Schwartz & Alessandro Rosiello

To cite this article: Mor Shilon, Dan Kaufmann, Dafna Schwartz & Alessandro Rosiello (2021): Smart specialization: a spontaneous four-step process in the mixed Arab–Jewish region of Haifa and Nazareth, *Regional Studies*, DOI: [10.1080/00343404.2021.1948524](https://doi.org/10.1080/00343404.2021.1948524)

To link to this article: <https://doi.org/10.1080/00343404.2021.1948524>



© 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



View supplementary material [↗](#)



Published online: 27 Jul 2021.



Submit your article to this journal [↗](#)



View related articles [↗](#)



View Crossmark data [↗](#)

Smart specialization: a spontaneous four-step process in the mixed Arab–Jewish region of Haifa and Nazareth

Mor Shilon^a , Dan Kaufmann^b, Dafna Schwartz^c and Alessandro Rosiello^d

ABSTRACT

Smart specialization is studied in the Arab–Jewish region of Haifa and Nazareth, with a focus on high-tech ventures created by Arab entrepreneurs. We find that not only did smart specialization occur under these complex conditions, but also it was spontaneous. It began with the sharing of entrepreneurial knowledge held by Jewish entrepreneurs through social networks set up by grassroots organizations. Policy initiatives in support of this process followed, helping to reshape the region's socioeconomic structure. Therefore, we argue that smart specialization followed a four-phase process: a pre-phase of knowledge transfer between the two communities, followed by Foray's three phases.

KEYWORDS

Smart specialization; start-ups; regional economies; innovation policy; networks; minority integration

JEL O12, R11, R58

HISTORY Received 3 April 2020; in revised form 19 June 2021

INTRODUCTION

Instead of top-down 'one-size-fits-all' policies that entail financing national governments rather than regions and fashionable sectoral targets rather than realistic opportunities to diversify a region's industry structure (Balland et al., 2019), smart specialization is a policy framework emphasizing the exploitation of existing areas of strength to generate new technological and industrial capabilities (Foray et al., 2011). It can be used to develop competitive advantage and diversify into high value-added activities. The European Commission (EC) adopted Smart Specialisation to promote strategic diversification at a regional level and economic growth as part of its Cohesion Policy framework for the period 2014–20.

Smart specialization seems easier to adopt in regions with complementary areas of strength (Asheim, 2019). Under crisis conditions or in lagging regions, the likelihood of success is relatively low (Komninos et al., 2014; Morgan & Marques, 2019). However, it is precisely in


these regions that it is most necessary to develop new forms of specialization. As opportunities for development often lie outside individual regions (Hassink & Marques, 2016; Organisation for Economic Co-operation and Development (OECD), 2013), the EC promoted cross-sectoral as well as cross-regional knowledge exchange and cooperation.¹

We posit that smart specialization could also be applied to mixed-population regions, characterized by complex conditions of distant relations between ethnic majorities and minorities that may face conditions of disadvantage. Our study traces a unique process of smart specialization in a mixed region consisting of the advanced city of Haifa (ranking seven out of 10 in the Israeli Socio-economic Index) and the economically lagging Arab city of Nazareth (with a lower rank of three out of 10).² Haifa and Nazareth are part of the same 'Haifa/Northern region', with Nazareth being located at the edge of the Haifa Metropolitan area. Haifa consists of advanced higher education and research and development (R&D)


CONTACT

^a  mor.shilon@campus.technion.ac.il

Department of Urban and Regional Planning, The Technion – Israel Institute of Technology, Haifa, Israel.

^b  Kaufmann.Dan@gmail.com


Department of Economy, Sapir Academic College, Ashkelon, Israel.

^c  dafna.schwartz@idc.ac.il

Adelson School of Entrepreneurship, Interdisciplinary Center, Herzliya, Israel.

^d **(Corresponding author)**  alessandro.rosiello@ed.ac.uk

University of Edinburgh Business School, Edinburgh, UK.

 Supplemental data for this article can be accessed at: <https://doi.org/10.1080/00343404.2021.1948524>.

centres that serve the Arab population of the north (around 27% of the Technion's BA students are Arabs). Nazareth, being located 44 km from Haifa, has come to be known as 'Silicon Wadi' (Schneider, 2018) and currently offers attractive technological parks and a workforce including engineers and high-tech entrepreneurs.

Given the ongoing transformation within the Arab economic enclave in the north of Israel since the mid-2000s, we formulate two research questions:

- Is smart specialization viable in the complex settings of mixed regions such as the Haifa region?
- What are the required conditions (and preconditions) for a successful process of smart specialization in these regions?

To trace the process of smart specialization in Haifa and Nazareth, we draw on qualitative methodology, collecting primary and secondary data and analysing interviews. The findings demonstrate that in contrast to case studies of Smart Specialisation implementation in lagging regions of Europe (Karo & Kattel, 2015; Muscio et al., 2015; Papamichail et al., 2019; Potter & Smith, 2019) and socioeconomic disparities in Israel (Drori & Lerner, 2002; Sofer & Schnell, 2000), not only is smart specialization occurring in the Haifa region under complex conditions of majority–minority relations, but it is also supporting the inclusion of Arabs into the Israeli high-tech sector. Furthermore, rather than a result of targeted policy activities supporting the evolution of Arab entrepreneurship in Nazareth, entrepreneurial discovery was initiated by the spontaneous development of networks spanning the Arab and Jewish communities. Grassroots local organizations have been instrumental in activating this process, without policy support. This has led to the subsequent identification and exploitation of entrepreneurial opportunities by Arabs alone or in partnership with Jews, in technological domains that were new to their community.

Consequently, we argue that smart specialization in the mixed Haifa region comprises four phases. These include Foray's (2014) three-phase model of smart specialization process and a pre-phase of network formation and knowledge-sharing that we add to it. While at the outset of the smart specialization process in this region no direct policy was available, following sharing of entrepreneurial knowledge and various instances of entrepreneurial discovery, policy initiatives to integrate Arabs into the high-tech sector have been subsequently promoted.

Our results are important because they show that, considering the radical demographic changes and the growth of multicultural, mixed cities and regions, especially in Europe (Geddes & Scholten, 2016), smart specialization can occur spontaneously in these conditions, especially when technological entrepreneurship in the minority population has involved a link with the majority ecosystem since its inception. This process of knowledge diffusion can support the socioeconomic inclusion of the minority. Thus, in addition to policymaking for diffusion of

technologies and R&D support, the strengthening of social networks of minorities with the majority could be prioritized in policy approaches to trigger structural change in mixed regions.

The remainder of the paper is structured as follows. The next section provides a theoretical review of the concept of smart specialization and empirical evidence of its constitution in different contexts. It elaborates on the three-phase model that Foray (2014) claims is essential in spontaneous smart specialization. The third section focuses on the case study of the mixed Haifa region and the city of Nazareth and methodological approach. The fourth section presents our findings and discusses them with reference to four distinctive phases characterizing the smart specialization process in the mixed Haifa region. The fifth section analyses our findings. The last section presents conclusions from the analysis.

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

One of the emerging issues that occupies policymakers in general, and in Europe in particular, is building a better understanding of how to integrate disadvantaged minorities into growth activities. This study draws on the Haifa and Nazareth case to exemplify the contribution of the smart specialization framework to this process.

Theoretical background

Developed as a possible response to economic challenges in Europe, and particularly for the productivity gap between the United States and Europe (McCann & Ortega-Argilés, 2015), the policy concept of Smart Specialisation was quickly adopted by the EC, which has formulated the Research and Innovation Strategies for Smart Specialisation (RIS3), a platform of services for the implementation of the initiative. The Smart Specialisation approach aims to diversify regional economies by potentially enabling any region to engage in the strategic diversification of its industry structure (Foray et al., 2011). Policies should therefore aim to strengthen the knowledge networks that transfer knowledge between technological domains, industrial subsectors and even regions (Santoalha, 2019).

Distinctive technological or industrial domains can be prioritized according to their (potential) specialization 'regardless of being high-tech or low-tech, knowledge-intensive or capital-intensive' (Janger et al., 2017, p. 39). Put differently, to make proper use of public funds rather than providing neutral support with no priorities, every region within the EU will build upon its own strengths and potentials. To compete in the global economy, each region should opt for 'ambitious yet realistic priorities (niches) where it would be able to develop excellence' (Carayannis & Rakhmatullin, 2014, p. 214).

Recognizing opportunities for strategic diversification depends on the ongoing enhancement of existing capabilities via integration of entrepreneurial knowledge and economic knowledge (Foray, 2014). Through inter-

organizational networks, companies – the main though not the only entrepreneurial agent – can absorb new knowledge to develop and dynamically align their capabilities with those of other actors (suppliers, customers, universities, industrial partners) and then harness such capabilities to new purposes (Von Tunzelmann, 2009). It follows that the entrepreneurial discovery vital for regional growth requires the sharing and absorption of the necessary knowledge, enabling entrepreneurial agents to recognize emerging opportunities, adapt to new scenarios and anticipate and act upon circumstances that may become critical (Cope, 2005).

From a regional perspective, this kind of entrepreneurial learning (Cope, 2005) enables the discovery of innovative domains in which the region can excel. This is primarily the responsibility of entrepreneurs who are best placed to discover the most promising domains (Foray, 2014; 2015). Once these are discovered, a transitive path towards structural change can be enacted by means of collective action, involving more companies, suppliers and innovators (Foray, 2014, 2018).

At the same time, this kind of learning does not happen in isolation. Instead, it tends to be a highly contextualized process (Harrison & Leitch, 2005), as by means of knowledge exchange and interactions local actors can become not only more innovative and creative, but also more productive as they adopt better practices (Rodríguez-Pose & Crescenzi, 2008). The social, institutional and cultural environment within which entrepreneurs are embedded will shape their outlook, strategic vision and behaviour, and propensity to establish and use personal connections and networks (Cooke et al., 1998; Spigel, 2017), while the region's business, economic and socio-institutional contexts define the type and extent of networking, learning and entrepreneurial opportunities available (Malecki, 2009).

Unlike previous horizontal policy frameworks, smart specialization prioritizes sectors and technologies according to the capability profile of each region. However, bearing in mind that entrepreneurship and innovation potentials differ within regions, instead of a unified approach that can be transferred from region to region, the implementation process significantly depends on the socio-institutional environment and business context (Asheim, 2019; McCann & Ortega-Argilés, 2015). Accordingly, the challenges that regions may have to face while implementing smart specialization differ, which means that policies must be adapted and transformed having systematically examined the opportunities and weaknesses of the regional context.

Although in Europe RIS3³ hinges on a shared policy framework aimed at stimulating entrepreneurial learning, collective action and effective governance, smart specialization can take place without directed policy – in a decentralized and spontaneous form. In the latter case, it must rely on existing entrepreneurial capabilities (Foray, 2018) to generate the necessary learning about what the region can specialize in to transform itself into a modern economy (Hausmann & Rodrik, 2002). For example, in the region

of Morez, a nail manufacturer established a new economic domain because he understood that his technique for nail production would also allow him to produce glasses. Twenty years later, 'Morez became a world-class centre for the manufacture of glasses' (Foray, 2014, p. 493).

Smart specialisation in lagging regions

With the rapid implementation of Smart Specialisation in Europe, the growing gap between the concept in theory and its practical implementation came to be recognized (Foray et al., 2011). As a result, scholars have begun to empirically examine its feasibility in different contexts. Muscio et al. (2015) draw a parallel with the concept of innovation paradox (Oughton et al., 2002), according to which, regions that have the greatest need to invest in innovation are also the ones with the most limited capacities to absorb public funding. Morgan (2013) identifies three major challenges of smart specialization: conceptual, operational and political. The conceptual challenge refers to the gap between theory and practice with respect to the implementation process. The operational challenge refers to the transformation of the concept into a policy agenda. Finally, the political challenge refers to the need for (all) regions to follow the suggested policy agenda. Kroll (2015) suggests that there are three kinds of regions to be considered: starters, active beneficiaries and drivers. Given their planning culture and governance patterns, the first type are regions that must invest significant effort in implementing the initiative, the second type are regions that can benefit the most from the implementation of smart specialization, and the last are leading regions that might have done well enough without it.

Examining the applicability of smart specialization in regions that must invest significant efforts, scholars have discovered practical implementation challenges that need to be addressed, particularly in Eastern and Southern Europe. Papamichail et al. (2019) examine Smart Specialisation implementation in Central Macedonia and Crete and find that the paucity of entrepreneurial capabilities constitutes a critical impediment to the process of entrepreneurial discovery. Furthermore, the problem is aggravated by features of the institutional environment, such as the prevalent disconnection between the local science base and industrial R&D that inhibits knowledge-sharing (McCann & Ortega-Argilés, 2019; Vallance et al., 2018), as also exemplified by Potter and Smith (2019) in the Polish context. Komninos et al. (2014) examine Smart Specialisation implementation under crisis conditions in Greece, Slovenia and Cyprus, where budget and the unwillingness of authorities to implement Smart Specialisation and of companies to be involved in such initiatives all challenge effective implementation. Bečić and Švarc (2015) analyse the case of Smart Specialisation implementation in Croatia where, inter alia, technological development, diversified economic structure and poor investments in R&D only allow for a reduced realization of Smart Specialisation.

Altogether, it appears that in lagging regions, where there is a paucity of technological, industrial and entrepreneurial capabilities, challenging preconditions and institutional hurdles must be solved before policy implementation (Karo & Kattel, 2015). Since complementary knowledge and capabilities are often available outside individual regions (Hassink & Marques, 2016), RIS3 promotes both cross-sectoral and cross-regional knowledge transfer and cooperation.

Haifa has an advanced ecosystem that includes centres of technological excellence such as the Technion and Rambam Health Care Campus, as well as large venture capital companies such as Jerusalem Venture Partners or Sarona Partners, the latter recently opening its SigmaLab accelerator. Although Nazareth performs economically as a lagging city, a significant change was observed in its economy beginning in the mid-2000s, involving entrepreneurial learning as well as a changing relationship between communities that are geographically proximate but socially and economically distant. Thus, our study investigates the process of smart specialization in Nazareth and the shifting socio-institutional conditions shaping this process.

Spontaneous smart specialization

Foray (2014) addresses three important phases in the spontaneous constitution of Smart Specialisation: entrepreneurial discovery, spillovers and entry of similar or complementary businesses and structural change in the pattern of radical foundation.

The idea of entrepreneurial discovery exceeds the notion of innovation, as it includes the realization of plausibility in relation to the market. It is 'the deployment and variation of innovative ideas in a specialised area that generate knowledge about the future economic value of a possible direction of change' (Foray, 2014, p. 495). It includes the process of entrepreneurial exploration and discovery that can result in a structural change. For entrepreneurial discovery to take place, different sets of knowledge (e.g., technological, entrepreneurial and market related) are combined. These knowledge sets integrate knowledge generated from different actors, for example, companies, universities, research labs, suppliers and clients.

Spillovers and entry of similar or complementary businesses refer to the idea that the entrepreneurial discovery aims to inform agents in the region of new opportunities and potentials. This can be partly achieved by means of the visibility of success stories that others can follow (as was the case in Nazareth). The entry and proliferation of enterprises in the new domain (or in related fields) can make the lagging region a leader.

Finally, structural changes and related variety refer to the change in the region's economy. In this regard, Foray identified four logics: (1) transition, which is a process of a new domain being established based on an existing domain; (2) modernization, which refers to the use of a general-purpose technology for the efficiency of an existing domain; (3) diversification, which refers to the integration of existing domains with a new domain

in a specific region; and (4) the establishment of a new economic domain unrelated to the existing knowledge base. Regarding this pattern, Foray (2014) explains that the fourth pattern entails:

the radical foundation of a new domain. This case does not fall into the related diversification pattern and involves the opening of exploitation opportunities unrelated to any existing productive assets.

(p. 499)

Venturing into a new and technologically more complex domain should not be seen as a 'casino strategy' (Baland et al., 2019), but rather as a necessary step towards necessary structural change, involving knowledge-sharing and the developing of new capabilities especially in the context of lagging regions (Asheim, 2019).

The ability of entrepreneurs and companies to discover viable domains for strategic diversification hinges on the way in which they build external network connections with universities, laboratories, suppliers and users (Asheim, 2019). This study investigates the role played by emerging connections and networks between the Arab minority and the Jewish majority in Haifa, which will lead us to suggest the addition of a pre-phase of network formation and knowledge-sharing to Foray's (2014) three-phase model, as mentioned above.

METHODOLOGY

To trace smart specialization patterns in a mixed region, we draw on the case study method. We located a region in which a transformation is taking place in this regard: the mixed region in the north of Israel, which consists of the advanced Jewish city of Haifa and the economically lagging Arab city of Nazareth.

Context: the mixed Haifa region case study

The city of Haifa has 278,900 inhabitants, of which 78.7% are Jews and 11% Arabs.⁴ Haifa is the economic centre of the northern region of Israel and has both traditional industries (e.g., chemical industries and logistics) and advance technological sectors (e.g., biotechnology, information technology and nanotechnology at the MATAM high-tech and business park); four public hospitals; and two major Israeli universities: Technion – Israel Institute of Technology and Haifa University. The Technion, a science and technology research university, was established in 1912 as the 'Technikum'. Three Technion professors have won Nobel Prizes. According to Technion's president, in 2016, 20% of the institution's bachelor's degree students were Arabs, and of these, 45% were women.⁵ Haifa University was established in 1972. It offers studies in the fields of humanities, social sciences, law, welfare, health sciences, natural sciences, education and management. It is the most pluralistic institution of higher education in Israel, with secular and ultra-Orthodox Jewish, new immigrant, Arab and Druze students.⁶ In 2012, 30.3% of the bachelor's degree students there were Arabs

(Ali, 2013). As the main economic centre of northern Israel, Haifa has six leading sectors: information and communication technology (ICT), life sciences, the chemical industry, tourism, the sport and leisure sector, logistics, and the aerospace and defence industry (Benner et al., 2016).

Nazareth is the largest Arab city in northern Israel, with 76,000 inhabitants: 70.4% Muslim and 29.6% Christian and a social centre that serves the surrounding Galilee population. Known as the Arab capital of Israel (Gelbman & Laven, 2016), it is a heritage tourism centre for visitors from around the world. Nevertheless, Nazareth is only rated three out of 10 in the socioeconomic index of Israeli cities though it is ranked the highest among all Arab cities in Israel.⁷ The Israel Central Bureau of Statistics (CBS) affirms that most Arab cities are ranked much lower in the socioeconomic index than their neighbouring Jewish cities. Such a gap may impede any efforts aimed at increasing social cohesion among mixed regions and can be a source of tension.

Data collection

The case study method necessitates an in-depth examination that draws on multiple sources for information (Creswell, 1998). However, the process we examine only gained momentum in the mid-2000s. Therefore, to the best of our knowledge, no accurate statistical or descriptive data regarding this transformation exists. Furthermore, full information about the names of Arab entrepreneurs and companies is still unavailable. Finally, the literature, which often addresses the disparity between Arabs and Jews in the Israeli market, reports on studies that employed quantitative tools and thus is based on relatively old data (Khattab & Miaari, 2013). For these reasons, and to gather data and information on the most recent developments within the Arab economy in Nazareth, we employed qualitative methodology, using primary and secondary data gathering, analysis, and semi-structured interviews.

We traced data regarding the evolution of the Arab high-tech industry, linkages and knowledge transfer between Arabs and Jews in the mixed Haifa region. General primary data and statistics were gathered from the Israel CBS and from official municipal and government websites. To characterize the mixed region of Haifa and the city of Nazareth in detail, we gathered primary data from the databases of the Israel CBS and secondary data from various associations and organizations and academic and official authorities' reports.⁸

We conducted 35 semi-structured interviews with key actors and agents constituting the innovation environment in Nazareth. These include 18 entrepreneurs, three consultants, the chief executive officers (CEOs) and stakeholders of nine incubators and accelerators, and five officials from different authorities.⁹ Interviewees were chosen by snowball sampling and available lists from organizations such as the Agency for Small and Medium Businesses (Maof) and Israeli Venture Capital (IVC) Database. Arab entrepreneurs were not easy to access, mainly because there were no accurate data and contact

information for them, but also because only a small number of entrepreneurs have owned their companies for a long enough time to be known by others in the local area. Interviews took place in the informants' work offices to their request. All interviews were recorded and transcribed upon signed consent of informants.¹⁰ Interviews were analysed thematically in two phases to enable the researchers to reflect upon the interviews' themes, categories, and data collected.

We conducted interviews with entrepreneurs (mainly Arabs, or Jews in cases of mixed teams) with a focus on both the successful and unsuccessful start-ups that had been launched up to the time of the interview. In particular, we were interested in analysing the influence of the different elements of the entrepreneurial ecosystem of the Haifa/North region on their decision to become entrepreneurs. The interviews focused on the main elements that influenced their economic knowledge, technological innovations, possibilities for knowledge and data spillovers, and past and present collaborations with different ethnic populations, as well as the collaborations with a Jewish urban centre. Moreover, interviews thoroughly scrutinized the problems entrepreneurs faced during training, development, and collaborations. Other interviews we conducted with stakeholders, advisers, and officials who play a role in the national innovation ecosystem supplied data on the growing innovation environment and support system in Nazareth by probing into the training processes of entrepreneurs, tools for entrepreneurship, policy schemes and collaborations with other sectors, advisers and institutional aids along the way.

Data analysis

We produced four interview protocols which target our four informants' groups: entrepreneurs, officials, consultants, and incubators and accelerators' CEOs. While the main queries within these protocols are similar, we made adaptations to meet the different perspectives each group of informants is more likely to share. After conducting and transcribing the interviews, we analysed them thematically. We first marked all repetitive patterns across the different interviews and encoded them (e.g., barriers to initiate a start-up, traditional aspects, established relations with state authorities). On the second phase of analysis, we grouped these codes to main themes generating data about entrepreneurs' life stories in terms of similarities and differences. These themes are: previous professional experience; networks; policy tools; institutions; social aspects; socio-spatial aspects and ecosystem. Accordingly, we were able to derive insights regarding the barriers and potentials, advantages and drawbacks, and general progress and development of the start-ups in Nazareth, the emergence of a new industrial domain, and the policy initiatives and local institutions that support this process.

RESULTS AND DISCUSSION

In the early 1990s, the high-tech industry in Israel entered a period of rapid growth (Avnimelech & Schwartz, 2009).

At that time, Arab technological capital and start-ups were nearly non-existent. From the mid-2000s, Arab high-tech entrepreneurship began to emerge, despite the absence of an explicit policy agenda. Nazareth, a cultural centre for the Arab community in Israel and a religious centre for foreigners, is becoming a centre for technological development for Arab entrepreneurs (Schneider, 2018). In what follows, we will address this transformation, which consisted of a pre-phase of network formation, knowledge-sharing and entrepreneurial learning between the majority and the minority, followed by the three phases of Foray's (2014) model.

In practice, these different phases often happen simultaneously – engagement with the Jewish milieu, for example, does not start at one point and end before the entrepreneurial discovery phase begins. This engagement supports entrepreneurial discovery. However, in the case of mixed regions, we argue that the entrepreneurial knowledge transfer and the subsequent learning process have been a crucial precondition for entrepreneurial discovery.

Pre-phase: network formation and knowledge-sharing

The Arab entrepreneur's profile is different than the (Jewish) Israeli one. There are Arab entrepreneurs who worked for high-tech companies or even in the Silicon Valley. Yet, they don't have the know-how to run a start-up.

(Fadi Swidan, 2 March 2017)¹¹

During the 1990s, Arab industry in Israel expanded, yet remained in the margins of the Jewish economy. Sofer and Schnell (2000) argue that:

the current pattern of the Israeli Arab industry means, above all, being peripheral – small-scale production, operating in marginal niches (such as sewing shops, food, and construction materials), a limited level of technology, and the lack of capital. (p. 2232)

According to the OECD (2016), in 2012 Arabs owned 14% of the total businesses in Israel. Of these, 89.7% were in the fields of construction, transport, storage, mail and courier services, wholesale and retail trade, vehicle repair, manufacturing, and mining and quarrying. Arabs owned only 1.6% of high-tech businesses.

However, since the mid-2000s, Arab high-tech entrepreneurship began to emerge, particularly in Nazareth. Our data show that entrepreneurial knowledge-sharing was an integral part of this process. We found extensive evidence that newly formed networks provided Arab entrepreneurs with the necessary capabilities to identify entrepreneurial opportunities, develop new technologies, raise funds, present ideas on different platforms and build strategic relationships with key actors and relevant stakeholders in the Haifa high-tech ecosystem and Israeli market.

This process of formation of new networks spanning the two communities was initially spontaneous. The first

to identify and advance it were grassroots organizations and bottom-up initiatives of Arab and Jewish entrepreneurs. In this phase, there was no direct interaction between Arab entrepreneurs and policy initiatives aiming at supporting them. For these spontaneous networking and learning to take place, Arabs connected and interacted with Jews – whether consultants, mentors, investors, or managers – who were more literate in the field of high-tech entrepreneurship due to, *inter alia*, historical conditions of inequality (Sofer & Schnell, 2000).

To be a technological entrepreneur you must work with Jewish engineers and managers, you must have Jews with you. It is not only about living in Israel, but also about working with many ministries and offices – accountants, lawyers, patents, other supporting companies. It is a must!

(Muhammad Haj-Ali, 15 February 2017)

In 2008, two main unconnected privately owned grassroots organizations brought about bottom-up initiatives that supported the networking and knowledge-sharing between Jews and Arabs. The first was the initiation of Tsofen organization – established by Arab and Jewish entrepreneurs – aiming to train Arabs from the north (mainly from Nazareth) to work in high-tech companies.¹² In addition, Tsofen acted towards pulling multinational and major high-tech companies (e.g., Microsoft, Amdocs, Broadcom) to locate part of their activities in Nazareth, *inter alia*, to employ the newly trained Arab workers. The second organization was a for-profit software company established by Arab and Jewish entrepreneurs – Galil Software – that targeted the employment of Arabs in high-tech activities that involve both Jews and Arabs. These two initiatives focused on advancing the proliferation of Arab high-tech activities by creating pertinent positions in the market and establishing long-term connections between Arabs and Jews. Tsofen emphasized interpersonal links between Jewish and Arab professionals and entrepreneurs, whereas Galil Software devoted its efforts to establish connections with high-tech companies led by Jewish entrepreneurs.

The flow of key entrepreneurial knowledge via Arab-Jewish connections constituted a precondition for developing essential skills for entrepreneurial discovery, consisting of new technology companies in Nazareth that were started by Arabs. Of the 18 Arab entrepreneurs we interviewed, nine established social ties through with Jewish entrepreneurs through the abovementioned organizations, three based their venture initially on Jewish clients, and six had worked for companies managed by Jewish entrepreneurs.

Some Arabs started to engage with the Jewish high-tech milieu either by studying at the Technion or at Haifa University or working at Jewish high-tech companies (e.g., MATAM Industrial Park) or labs at Israeli universities and hospitals, all located in the region of Haifa. Interviewee 1 describes his partner's track in developing their shared enterprise, which was physically located

in Nazareth, but was established through the connections he and his partner made at the Technion:

When I was studying at the Technion, I did not know anyone. But after some time, when people got to know me, they hired me and referred me to other employers. ... After launching our [his and his partner's] firm, we were hired by scholars who worked with me at the Technion.

(interviewee 1, entrepreneur, 2 March 2017)

Sami Saadi, one of the founders of Tsofen, argues that social ties assist Arab entrepreneurs in finding human resources as well as gaining access to the capabilities and skills needed for later applying for governmental schemes¹³ and presenting structured ideas to prospective investors. He notes that:

[in our accelerator] they learned about marketing programmes, they got mentors, learned what funds are, how to invest, how to make a presentation, and how to present their idea in 30 seconds – in English.

(1 February 2017)

Additionally, our data show that Jewish mentorships provided to Arab entrepreneurs in these organizations served as links to the Jewish high-tech community, where a wealth of technological and commercial experience and services can be sourced. In turn, these experience and services were in many cases instrumental in building viable technological solutions and strong customer value propositions.

A further initiative that took place in 2012 was the initiation of a private–public initiative of the Nazareth Business Incubator Center (NBIC). A centre supported and subsidized by the Ministry of Economy and MATI (Center for the Cultivation of Entrepreneurship) which is an organization funded by the Ministry of Industry, Trade and Labor. In 2014, due to an organizational change, Maof replaced MATI, soon after the Hybrid accelerator was established and added to the centre. According to Fadi Swidan (NBIC incubator and accelerator, co-founder at The Hybrid), the accelerator added technical resources to those provided by NBIC, and accelerated network connections for young Arab entrepreneurs.

I enrolled for the NBIC Hybrid accelerator and was chosen out of many people. Via the Hybrid my connections with Israeli high-tech personnel such as people from Amdocs were established.

(interviewee 6, 26 March 2020)

Subhi Basheer explains that immediately prior to launching Enzymotec in 1994, connections with Shulamit Aloni, then Minister of Communications, assisted him in establishing an R&D centre as part of The Galilee Society – The Arab National Society for Health Research and Services. There, he explains:

we started to work on studies via the Ministry of Science, Technology and Space. After a while, we received larger projects and studies such as Middle Eastern Regional Cooperation. After that, in 1997, I decided to launch my own firm.

(21 March 2017)

This exemplifies a perceived need for advanced governmental support in infrastructures that provide space for interactions between Arabs and Jews, possibly reflecting a more general tendency to establish further connections and networks between two communities with different levels of entrepreneurial knowledge, to facilitate knowledge transfer between them.

As this research investigates a process that is still a work in progress, its results and those of the newly formed connections and networks – the success rates of these new Arab start-ups – illustrate a process that is still ongoing. Nevertheless, the relational nature of the entrepreneurial learning process during this pre-phase was addressed in various forms in almost every interview we conducted. Repeatedly, the significant role of networks and collaborations of Arabs with Jews was noted as a required preliminary phase in the entrepreneurial discovery process. We posit that this phase of network formation precedes three phases included in the Foray's (2014) model. During this phase, most Arab entrepreneurs found their way to high-tech entrepreneurship, as they were exposed to and worked together with Jewish mentors, consultants, investors and managers of other companies. Starting in 2008, this repeatedly happened through network connections that grassroots organizations such as Tsofen and Galil Software helped to set up. Only a few years later, public–private entities such as NBIC began to emerge.

Entrepreneurial discovery

As mentioned, we found that the first phase of Foray's (2014) three-phase model took place in the Haifa region. Our data suggest that rather than policies to support Arab entrepreneurs, it was thanks to the networks that were established in the initial phase of the smart specialization process that they were able to discover opportunities that were new to their disadvantaged community. Arab industry in Israel is still based on traditional labour-intensive sectors such as construction, wholesale trade and repair of motor vehicles. However, jobs created by newly established high-tech companies grew by 190% between 2012 and 2018, in domains such as pharmaceuticals, computers manufacturing, electronic and optical equipment, manufacture of aircraft, spacecraft and related equipment, computer programming, data processing, storage and related services, internet gateway sites, and R&D in advanced engineering and life sciences.¹⁴ The epicentre of this process of entrepreneurial discovery is the city of Nazareth (Schneider, 2018).

In what follows, we present the findings from the interviews we conducted, demonstrating how three Arab entrepreneurs discovered the potential of Arab technological start-ups. An entrepreneurial discovery is a viable

domain of structural change, into which various industrial actors can move to innovate and exploit market opportunities. This process of discovery generates new technological knowledge as well as knowledge about ‘what works (and does not work) economically’ (Foray, 2014, pp. 495–496).

Belal Lehwany, CEO and founder of VPSign (his second successful start-up), began his path as a technological entrepreneur working in a Jewish company, Better Online Solution (BOS), where he gained knowledge regarding the market’s demands and needs:

There were lots of sales. Most of the market was in the US. ... And that is how it progressed. I became very knowledgeable about this field and I also learned how to work with clients. I was the only one who oversaw printing. And then, after I observed and learned what clients needed, I told my CEO that I had an idea for a new product.

(25 January 2017)

Working in BOS, Lehwany established strong connections with major Jewish customers:

Bank Hapoalim¹⁵ contacted us. There were all kinds of stories, but there was success after success, and every success was bigger than the one before. I sold the product for \$3,000, then \$14,000, then \$70,000. We had a new product, and it was growing fast. We worked with Bank Leumi. Then Bank Hapoalim wanted to work with us.

(25 January 2017)

Lehwany worked in a milieu that included many major customers and under a CEO who was quick to realize the benefits of hiring Lehwany for his company and promoted him. Meanwhile, in line with Foray’s (2014) claims regarding entrepreneurial discovery (2014), Lehwany gained entrepreneurial knowledge that was mobilized into the discovery process, resulting in an output of economic knowledge, including managerial competencies, until he could become independent enough to launch his own start-up. Lehwany discovered his potential, as an Arab located within the mixed Haifa region under conditions of complex majority–minority relations, to become a technological entrepreneur and establish a start-up. As Lehwany put it:

From BOS I learned what entrepreneurship was. I did it without formal courses to identify a need and to find a solution for it, which will also be reasonable in terms of costs – this is knowledge I gained working in BOS.

(25 January 2017)

In a similar fashion, another interviewee (i.e., no. 1) and his partner launched their start-ups in the 1990s, a time when most of the high-tech industry was strongly linked to defence and the military, making it impossible for Arabs to take part in it, as they do not serve in the Israeli Army. Previously, he had worked at the Technion’s Faculty of Medicine, where he built devices for the faculty researchers. He stated, ‘As a result, I gained the

entrepreneurial experience of building medical devices. Then, I was hired by a firm to build more devices’ (2 March 2017). During these years, he gained the experience needed for launching a start-up. They established two companies in Nazareth. One sold software programmes for architects. In the room next door, they started their own medical device company:

We got jobs from the researchers at the Technion that Said used to work with. We started as subcontractors, working for researchers at the Technion, The Hebrew University and Tel Aviv University.

(2 March 2017)

They were quick to realize they could launch their own enterprise rather than work for others, understanding their potential as independent technological entrepreneurs who could launch their start-up in Nazareth:

We thought it didn’t make sense that Israel was a start-up nation, but Arabs weren’t taking part in it. Therefore, we started thinking of having a business of our own. If the Jews did not want to hire us, then we’d be subcontractors for high-tech companies. We would establish a firm of our own, producing our own devices.

(2 March 2017)

The events of both stories took place at a time when there were very few Arab technological entrepreneurs in Israel in general and in the mixed region of Haifa in particular. While both are now recognized as well-known examples of pioneering Arab entrepreneurs in the tech sector, our data shows that the other 16 entrepreneurs in our sample have followed in their footsteps, leveraging connections to Haifa’s entrepreneurial ecosystem. In at least nine out of 16 cases, the most relevant network was created by organizations such as Tsofen or by other incubators such as NBIC. Presenting a more recent case, interviewee 4 share a similar development to the pioneers with his start-up established in 2014:

At the beginning I worked for Israeli start-ups. There, I found out about the opportunity for my invention. My start-up focuses on the same field and the connections I established working for the Israeli companies have assisted me along the way. Nowadays, I sell to the same clients I sold to working for the Israeli companies.

(24 March 2020)

In summary, this section exemplifies instances of entrepreneurial discovery that relied on knowledge-sharing via social networks and consist of the identification of new opportunities, including present market needs and inspiring ideas for new products and services.

Spillovers and entry of similar or complementary businesses

The second stage in Foray’s (2014) three-phase model relates to the point when emergence of a new domain

gains momentum, establishing a core of companies upon which structural change (the third phase in the model) can take place. It coincides with the entry of new actors into the new domain, confirming the discovery is meaningful. So, when is a new economic domain established in a regional setting? According to Foray (2014), ‘when the initial experiment and discovery are successful and diffused, other agents are induced to shift investments away from older domains with less growth potential to the new one’ (p. 497). Arab entrepreneurs have become known role models with a word of mouth spreading within their communities. However, the establishment of organizations such as Hybrid (2015), Hasoub (2014), Tsofen accelerator (2014) and Mobile Monday (2012) in Nazareth which have focused on pitching success stories, has also played a major role in making role models known in the Arab as well as Jewish societies. Particularly, 67% of the 46 listed companies in Nazareth in 2018 were set up after 2012.¹⁶ Not only did the establishment of these organizations, the development of their networks and the entrepreneurial ventures they supported brought about a cultural shift in the Arab society (i.e., changing attitudes towards entrepreneurship as a career in the Arab society), but also for Arabs entrepreneurs in particular, the potential to connect and widen their network with Jews became an actual possibility.

Arabs in Nazareth needed to witness or hear about success stories in the field of technological entrepreneurship. Belal Lehwany explained: ‘People try to imitate successes. That is what they do. If the only successes they hear about come from remote places, they cannot imitate them’ (25 January 2017). However, success stories appear to be important not only for entrepreneurs to imitate, but also for the Arab society. On the one hand, historical conditions of exclusion are accompanied by reluctance to invest in Arab start-ups:

If you are a Jewish investor and you meet an Arab entrepreneur, you will most probably think: ‘wait, what he really knows about social networks? He grew up in Nazareth, he is not part of the Tel Aviv vibe and hype. So even if it’s not a high-risk investment, the investor needs a lot of trust in the entrepreneur’s capabilities.

(Maroun Farah, 25 April 2017)

On the other hand, Arab society itself does not welcome high risks and tends to encourage career routes that are considered ‘safer’ than entrepreneurship:

In the Arab sector, when one states he works on a start-up, people do not think highly of him. They think he should look for a ‘safe’ job. That is because people do not see successes.

(Belal Lehwany, 25 January 2017)

Not only are young Arabs discouraged from taking unnecessary risks, but Arab capital owners themselves (i.e., potential angels) will not easily invest in start-ups due to the risks involved in these investments:

People who have money and are willing to invest in high-tech are mostly Jews. It is obvious. Arabs with capital would invest in more material things, such as real estate.

(Maroun Farah, 25 April 2017)

Put differently, support systems, including the important aid of angels – part of the investment culture adopted by the Jewish sector – are not common in Arab society:

There are no Arab angels because culturally, Arab capital owners prefer to invest in safe initiatives. They are not exposed to high-tech, and the whole issue of reducing or increasing risks in investments is not there yet. Therefore, we try to provide success stories.

(Sami Lahyani, 1 July 2017)

Success stories of Arab entrepreneurs – such as Belal Lehwany and Sobhi Bashee – contributed to create a broad culture of investment in high-tech entrepreneurship. These stories not only attracted entrepreneurs, but also exemplify the regional support system that followed which includes accelerators, incubators and financiers. Following the experience of the Hybrid accelerator, more initiatives followed that aimed at fostering entrepreneurship started. Among them are Mobile Monday Nazareth, a private open community platform for discussions on tech innovations and initiatives. Mobile Monday organizes ‘meetups’ almost once a month with each having 60–120 participants of which 30% are Jewish.

At the same time, the NGT3, Hasoub Accelerator and the Takwin Labs – a VC that supports Arab entrepreneurs – were created. Based in Nazareth, NGT3 is an important incubator established using public–private funding. It hosts biotech start-ups led by both Jews and Arabs, all supported by the incubator’s venture capital fund in partnership with European, American, and other Israeli financiers. Once incubated, new initiatives automatically receive financial support using funds from the Israeli Ministry of Economy.

These organizations not only targeted assisting and advancing new, local start-ups, but also made proactive efforts to become known in Nazareth and its surroundings. In fact, aside two interviewees that started their ventures in the 1990s, all the other entrepreneurs in our sample utilized at least one of these support organizations during their start-up’s initiatives. As new entrepreneurs started to search for opportunities, they found a functioning support infrastructure already in place, providing access to technical advice, skills, financial resources, and key business connections. Our data show that, for a growing number of Arab entrepreneurs, access to networks as well as incubators and accelerators has become a prerequisite to, first, discovering new opportunities and, second, acquiring the resources needed – technical knowledge, finance and market leads – to exploit them.

Structural change

While the opening of new areas of entrepreneurial opportunity can translate into a cumulative process that

Table 1. Arab high-tech developments, 2008–18.

Arab citizens	2018	2008
General population	1.8 million (21% of the Israel population)	1.6 million (20%)
Students in tech-relevant fields	5000 (10% of all tech students) 6500 (in 2019)	About 1000 (6.79%) 2–3% in 1985–2014
High-tech professionals	5000 of a total 120,000 (4.2%)	350 or a fraction of 1%
Arab-led start-ups	90 of 5000 (about 1.8%)	Handful
High-tech companies in Nazareth ^a	46	4

Note: ^aData are based on the IVC Database.

generates not only technological innovation, but rather ‘a structural evolution of the whole regional economy’ (Foray, 2014, p. 498), Schnell and Sofer (2006) describe the obstacles faced by Arabs in Israel in breaking out of their economic enclave within the context of the Israeli economy. They suggest that, among other factors, poor physical infrastructure, difficulty in mobilizing funding, physical and mental distance from the major markets, and dependency on Jewish production are barriers that impede entrepreneurship processes from taking place within Arab communities in Israel. These barriers still exist and were mentioned in the interviews we conducted.

In 2017, however, the Authority for the Economic Development of the Arab, Druze and Circassian sectors reported about 150 high-tech Arab companies throughout Israel, compared to 2007–2008, when there were almost none. The processes of entrepreneurial learning and discovery discussed in the previous sections have benefited from the emergent networks of Arabs in Israel. Since the mid-2000s, one of the epicentres of this transformation has been the region of Haifa and the city of Nazareth, with their emerging ecosystem for Arab high-tech entrepreneurship:

Arab start-ups in the North spring up like mushrooms; they deal with the same domains that Jewish’ start-ups deal with. They look, speak, think like the Jewish entrepreneurs, and live the same frenetic and demanding lifestyle. ... According to the Tsofen organisation, which aids Arab high-tech engineers, five medium-sized high-tech enterprises and a few more dozen start-ups were subsequently established by Arab entrepreneurs in Nazareth and the industrial areas in Upper Nazareth, Tefen, and Gush Segev.

(Goldstein, 2011)

Structural change in Nazareth reflects the logic of the fourth smart specialization pattern (Foray, 2014) as it:

involves the less frequent case of the radical foundation of a new domain. This case does not fall into the related diversification pattern and involves the opening of exploitation opportunities unrelated to any existing productive assets. (p. 499)

With the growth of the innovation community in Nazareth, a more complex ecosystem that includes technological accelerators, major companies (e.g., Microsoft) and social organizations (governmental or private) has evolved, constructing an innovation environment for future technological entrepreneurs. Moreover, the Israeli Innovation Authority (IIA) initiated support schemes for Arab entrepreneurship.

Recently, although not explicitly termed smart specialization strategy, policymaking and initiatives to advance the Arab sector and integrate it into the Jewish economy have slowly but continuously supported the Nazareth’s development as a centre of innovation and encouraged the mushrooming of technological start-ups in the city. The various IIA programmes to encourage Arab technological entrepreneurship are important facilitators of the growth of the high-tech industry in the Arab sector and were mentioned repeatedly in interviews as an important aid:

One of the main tools to draw on is the IIA. It is extremely important. It is a financial tool, but it also provides you with time, so you can do networking while being sponsored. It helps one to deal with the first obstacle one encounters. After that you have a success story that people can hear about. It increases the number of people who are involved in entrepreneurship in Nazareth.

(Maroun Farah, 25 April 2017)

Direct and indirect government initiatives can be divided into three main subject areas: (1) policy directed to increase the number of skilled workers in high-tech; (2) support programmes for Arab entrepreneurship; and (3) following governmental resolutions 3780 and 922, development of physical infrastructure to support Arab high-tech companies (e.g., industrial parks). Particularly, between 2017 and 2020 and following governmental resolution 2292, the Israeli government allocated 4.83 million NIS per year for integrating Arabs into high-tech companies. This was done, *inter alia*, via governmental financial support in Tsofen organization. That is, the Israeli government formally acknowledged Tsofen organization at this point. This act transformed Tsofen from a bottom-up initiative to an operational arm of the government directed towards policy implementation. In addition, 2292 resolution allocated 500 million NIS to financially support Arab students studying in high-tech related fields (Seif, 2019).

These initiatives are contributing to a structural change in the region. Table 1 shows a significant growth of Arab high-tech economy between 2008 and 2018. In 2018, an increasing number of Arab students had chosen technology related fields in Israeli universities (5000 students); 90 technology start-ups had been set up by Arab

entrepreneurs either in Nazareth or in the surrounding region of Haifa that employed in excess of 1200 people; and an additional 42 high-tech companies set up production and research centres. Overall, up to 5000 high-professionals worked for multinational corporations and entrepreneurial businesses located mainly in or around Nazareth. In 2020, NGT3 was home to 22 biotechnology companies, from agro-biotech to medical technology and drug discovery. This process has attracted the interest of private investors. For instance, Takwin is a venture capital fund established in Haifa in 2014 as a partnership between three major funds in Israel to invest only in high-tech companies with Arab founders. They later created Takwin Labs, an incubator that in 2020 hosted seven high-tech ventures, and Takwin Consult, a network of technology consultants to support Arab entrepreneurs (Inter-Agency Task Force on Israeli Arab Issues, 2018).

Some key events also illustrate the magnitude of the change that is currently taking place. Annapurna Labs were sold to Amazon in 2015 for about US\$350 million, and Jasper Design Automation to Cadence Design Systems in 2014 for US\$170 million. In the same period, Jewish–Arab start-up MindoLife signed a major contract with the Indian SAR group and Parlor, one the most significant agreement in biotechnology in the history of Israel using the innovation of a Druze scientist. Many of these successful players now work with local grassroots organizations to inspire the next generation of Arab entrepreneurs, some of whom are female entrepreneurs. Three of the start-ups recently established at the NGT3 incubator have been founded by women, including Metallo Therapy Ltd that received a US\$4 million investment in 2012 (Schneider, 2018).

Policy initiatives have had a positive impact on several levels. Practically, they provide minorities with funding. Conceptually, they help underserved communities to create success stories that can inspire future entrepreneurs and angel investors. These initiatives increased trust in state

authorities as they not only assist Arab entrepreneurs, but also ensure that this aid is as accessible as possible:

The goal of the authority is to integrate all minority sectors in the Israeli economy. We target integration in the international economy, which includes, inter alia, the development of high-tech systems. Working with the IIA and the Ministry of Economy, 50% of my time is invested in developing tools specifically for that. Social integration can be an additional result of economic integration.

(Sami Lahyani, 1 February 2017)

This statement suggests that in addition to having a positive impact on the Arab economy, economic integration can lead to sociocultural integration. The emergence of technology entrepreneurship in Nazareth stimulated the development of a support system that quickly grew in the city. Figure 1 describes the elements that make up this system, including the drivers of demand (entrepreneurs and local municipalities) and supply (governmental and non-governmental organizations and institutions) generated by the demand for support services and which subsequently reproduce the growing demands.

Table 2 describes the main supply drivers, their characteristics, and the various ways they support and promote Arab entrepreneurs in Nazareth. It addresses the body of supply (governmental official or non-governmental), the type of support provided (direct or indirect), and the support in practical terms (administrative and organizational services/soft skills/financial support/outsourcing).

These bodies and organizations constitute the pillars of Nazareth’s embryonic entrepreneurial ecosystem. Their impact is highly valued; interviewees frequently referred to these bodies and organizations as making Nazareth a centre for innovation. The growing start-ups in Nazareth

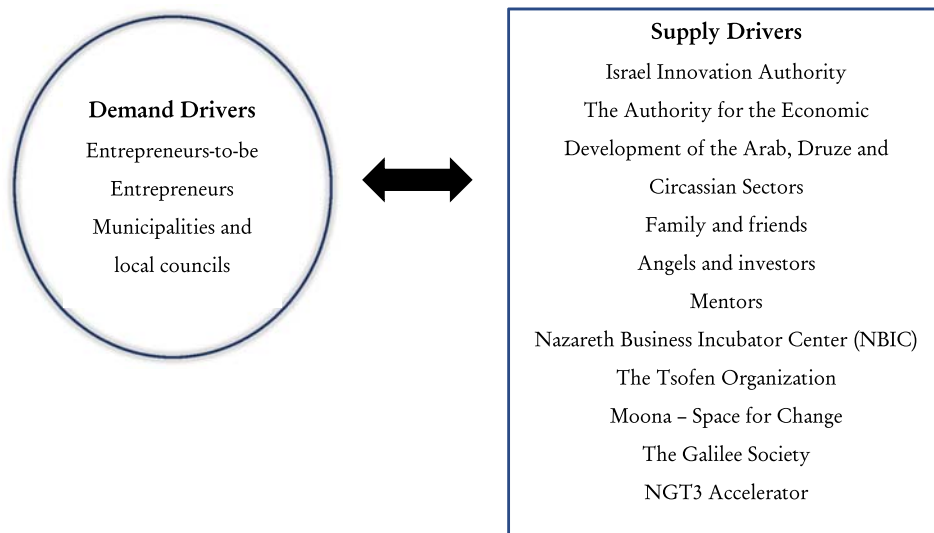


Figure 1. Demand and supply drivers.

Table 2. Initiatives in support of Arab entrepreneurship.

	Governmental/non-governmental	Direct/indirect support	Support provided
<i>The Israel Innovation Authority (IAA)</i> advises the government on topics related to innovation, and since 2015 has provided a unique scheme to promote minority entrepreneurs ^a	Governmental	Direct	Financial
<i>The Authority for the Economic Development of the Arab, Druze and Circassian Sectors</i> , established in 2007, develops financial tools and invests in funds that aid minorities, assists in making governmental aid accessible, collects data on Arab entrepreneurships, and, accordingly, aids the high-tech domain and its development in Nazareth. It plays a significant role in assisting Nazareth and the technological entrepreneurs within it to grow and expand, and thus has greatly influenced the structural change in Nazareth ^b	Governmental	Direct + indirect	Financial + outsourcing
<i>Family and friends</i> : entrepreneurs often draw on family and friends to support their start-ups during the early stages. Alongside emotional support, they often provide initial financial support	Non-governmental	Direct	Financial
<i>Angels and investors</i> provide initial financial support for entrepreneurs who are taking their first steps. Securing funding at early stages is a first milestone in running a start-up	Non-governmental	Direct	Financial
<i>Mentors</i> provide Arab entrepreneurs with emotional support and knowledge regarding how to present themselves and their ideas, and to access ventures and official schemes to support their start-up	Non-governmental	Direct	Soft skills
<i>Employers (firms and corporations)</i> : some of the most rudimentary suppliers for the growing industry of technological start-ups in Nazareth are established high-tech firms that employ Arabs (software and hardware engineers, and programmers)	Non-governmental	Indirect	Soft skills + outsourcing
<i>Nazareth Business Incubator Center (NBIC)</i> : since 2013, the NBIC has run the Hybrid accelerator programme, which targets early-stage ventures led by Arab, Druze and Bedouin entrepreneurs in Israel. Many Arab entrepreneurs have begun to run their start-ups with assistance from the NBIC ^c	Governmental	Direct	Administrative and organizational services/soft skills/outourcing
<i>The Tsafen Organization</i> , founded in 2008, serves as an accelerator, providing practical courses, mentoring, promotion of high-tech in Arabic cities, connections for Arab entrepreneurs-to-be with the Israeli high-tech sector, and assistance in integrating Arab employees into high-tech enterprises ^d	Non-governmental	Direct	Administrative and organizational services/soft skills/outourcing

(Continued)

Table 2. Continued.

	Governmental/non-governmental	Direct/indirect support	Support provided
<i>Moona: Space for Change</i> , established in 2014, is a technological centre that aims to develop an ecosystem by linking diverse communities, the academy and industries. It collaborates with the high-tech industry in technology-led projects that run in high schools and with apprentice students ^e	Non-governmental	Indirect	Soft skills ^f
<i>The Galilee Society</i> aims to achieve equitable health, environmental and socioeconomic conditions and to increase development opportunities for Palestinian Arabs inside Israel ^g	Non-governmental	Direct + indirect	Administrative and organizational services/soft skills/financial/outsourcing
<i>NGT3 Accelerator</i> , founded in 2002 and rooted in Nazareth, is a venture capital firm and partnership that invests in technological entrepreneurship. Its social agenda is to encourage Arab–Jewish entrepreneurship ^h	Non-governmental	Direct	Administrative and organizational services/soft skills/outsourcing

Notes: ^aSee http://www.matimop.org.il/about_authority.html.

^bSee <http://www.pmo.gov.il/English/PrimeMinistersOffice/DivisionsAndAuthorities/Pages/AuthorityfortheEconomicDevelopment.aspx>.

^cSee <https://www.thehybrid.io/hybrid-program>.

^dSee <http://www.tsofen.org/>.

^eSee <http://moona.co/moona-tech/>.

^fIn collaboration with the Ministry of Social Affairs and Social Services, Moona offers a programme that includes training and placement of engineers in enterprises in the north.

^gSee <http://www.gal-soc.org/article/4/About-The-Galilee-Society>.

^hSee <http://www.ngt3vc.com/about-us/our-story/>.

and the support system they have created have triggered structural change in the city's economy (Table 1). This ongoing transformation is the result of reciprocal relations between demand and supply drivers in Nazareth's growing high-tech sector.

ANALYSIS

The main findings of our study are two-fold. First, we found spontaneous smart specialization involving the Arab community in the Haifa region and especially in the city of Nazareth, with new path creation into new high-tech domains (Asheim, 2019) without any direct connection to the existing industrial structure of the Arab enclave. The growing numbers of Arab high-tech employment in Nazareth has led to several high-tech companies, including multinationals, opening centres in Nazareth. In parallel, private incubators and accelerators for entrepreneurs were established, investing much effort in creating networks of entrepreneurs for knowledge-sharing across the two communities and becoming a distinctive feature of the local socio-institutional environment. Altogether, these processes have set the basic conditions for entrepreneurial learning and discovery in the area.

Next, Arabs have been inspired by the success of their local peers and started to set up new start-up ventures. Entry of a growing number of Arab entrepreneurs and the development of supporting policy initiatives have followed, adding momentum to a transformative process,

and fostering the emergence of a microeconomic environment that increases the confidence of entrepreneurial actors in the economic process (Rodríguez-Pose & Storper, 2006). This process has extended to the present day; our data show that intermediaries such as incubators and accelerators of high-tech entrepreneurial activities, although not anticipating but following the first successful entrepreneurial attempts by the Arabs, have become crucial places for networking and learning. In this sense, our study reveals the beginning of a transformation that has not yet been fully realized, and probably for this reason – to our knowledge – has not yet been studied. As predicted by Foray et al. (2011) and Foray (2014, 2015, 2018), the socioeconomic structure of the Arab community is being reshaped, with examples of entrepreneurial discovery and new forms of specialization in sectors such as software, ICT, spacecraft equipment and biotechnology.

Second, we find that this spontaneous smart specialization process included Arab networking with the Jewish high-tech ecosystem from the outset. We find several instances in which the flow of entrepreneurial knowledge was made possible by existing personal connections and emerging networks among the different communities. These networks, links and connections prompted a pre-phase of knowledge-sharing between Arab entrepreneurs and mentors, investors, consultants and managers in Haifa, which enabled Arab entrepreneurs to become active. Even though it is now widely recognized that social

ties and collaboration are key to trigger diversification and structural change, in lagging regions strong emphasis on internal collaboration can lead to lock-in (Fitjar & Rodríguez-Pose, 2013) unless complemented by external networks enabling knowledge inflows from the outside (Santoalha, 2019). Our findings show this line of reasoning can also apply to different communities in the context of the same mixed region. They show that networks can contribute to shape the socio-institutional environment, enabling knowledge recombination as they help to deal with information asymmetries and dynamic coordination failures (Landabaso & Foray, 2014). For instance, we find that knowledge flows helped Israeli investors identify and assess investment opportunities, Arab entrepreneurs in Nazareth to find viable opportunities for industrial collaboration within the larger Haifa ecosystem, and local organizations and institutions to recognize the type of support, including financial resources which the new high-tech ventures need.

Although still emerging, Arab high-tech entrepreneurship in the Haifa region exemplifies a spontaneous smart specialization process that started in the mid-2000s. Policies and measures to support the process only emerged six to seven years later, with the realization that Arab entrepreneurship is a significant phenomenon that needs to receive support. From a policy perspective, it appears that to transform mixed regions with a concentration of minorities who are lagging behind with the context of high-tech regions, policies can focus on creating both the supply of and the demand for high-tech employment. On the one hand, unlike more traditional professions (e.g., medical doctors, nurses, and lawyers), starting or working in high-tech companies is being perceived as a high-risk career almost contradicting the social norms. In relatively poor communities, choosing such a career can be perceived as an irresponsible act (Nasri Said, Managing General Partner, Co-Founder, NGT3VC, 15 February 2017).

On the other hand, the development of a soft (networks) and physical infrastructure (including incubators, accelerators, and technological parks) and the emergence of new sources of public and private financial support are reshaping regional settings. Moving forward, successful smart specialization will likely depend on efforts to strengthen the regional innovation system, to improve the absorptive capacity of companies to promote the interaction between new ventures and research organizations and improve institutional structures (Tripl et al., 2019). More specifically, policies at this stage could provide incentives for high-tech companies to expand R&D activities in the region while fostering young people to study fields that are related to the high-tech sector or endow university graduates with the necessary skills. At a second stage, when technological capabilities have been accumulated, policies could focus on reinforcing entrepreneurial networks, including actors from both communities. In parallel, governmental support schemes that prioritize entrepreneurs from the minority group could be implemented.

CONCLUSIONS

The study investigates the process of spontaneous smart specialization in the mixed region of Haifa in Israel. It addresses two main questions: (1) Whether smart specialization is possible under the complex settings of this mixed region; and (2) What conditions (and preconditions) must be met for a successful smart specialization process in these regions. It focuses on the emergence of high-tech ventures especially in the Arab city of Nazareth, through the sharing of knowledge that is not new to the Haifa region but had never been accessed or exploited by the Arab community to engage in entrepreneurial discovery. It shows smart specialization can occur under the complex conditions of majority-minority relations in mixed regions, following four phases: a pre-phase of network formation spanning the two communities, followed by Foray's (2014) three phases of smart specialization. It appears that smart specialization has the potential to transform existing socio-economic structures.

Following these findings, we conclude that not only is smart specialization possible in mixed-population regions, but it can also support the inclusion of minorities by integrating them into the growth markets in their countries. Entrepreneurial knowledge transferred via social networks of Arabs and Jews started a process of structural change in Nazareth alongside the transformation of technological tools and financial support. Such a process was subsequently reinforced by targeted policies to create physical infrastructure, de-risk private investments and attract foreign investment. Inclusive policymaking, however, could target those networks and foster their establishment from the early stages (our proposed 'pre-phase' in a four-step model), contributing to the strengthening of entire regional system, including both the Jewish and Arab communities.

However, our study has some limitations. First, the results are difficult to generalize as the study is characterized by socio-institutional conditions and historical circumstances of a strongly idiosyncratic nature. Although a growing number of urban or regional economies in the world include mixed ethnic communities, the socio-institutional structure of Israel remains distinctly peculiar. This limitation also applies to the conclusion that a pre-phase of knowledge sharing between the two communities triggered the process of entrepreneurial discovery, even if the issue of cross-fertilization between geographical and technological domains is becoming increasingly central in the debate on the implementation of smart specialization (McCann & Ortega-Argilés, 2015; Santoalha, 2019).

Second, our methodology relies entirely on qualitative evidence. In this sense, the research process is still in its infancy, and future studies should use a broader dataset, including a larger sample of interviewees as well as up-to-date quantitative data and indicators of the regions in question. This is essential to quantify the significance of the process of economic transformation, the relevance of its driving factors, and the wider implications for the regional economy – both in Israel and abroad.

Third, more data and evidence would also help control for exogenous factors that contribute to triggering the expansion of the high-tech sector in Haifa – for instance, 2018 was a record-breaking year for start-up funding in Israel (reaching over US\$6 billion in total) – which can affect the process of entrepreneurial discovery within the Arab community.

ACKNOWLEDGEMENTS

We acknowledge variations between different data sources and relate these to the infancy of the process.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

FUNDING

The Israel Science Foundation [grant number 836/16] supported this research.

NOTES

1. See <https://s3platform.jrc.ec.europa.eu/interactive-ris3-guide/-/wiki/Main/PART+II>.
2. See the Israel Central Bureau of Statistics (CBS), http://www.cbs.gov.il/publications17/local_authorities15_1683/pdf/106_4000.pdf.
3. See https://s3platform.jrc.ec.europa.eu/what-we-do?p_1_back_url=%2Fsearch%3Fq%3Dwhat%2Bis%2Bsmart%2Bspecialization.
4. A total of 10.3% are of other origin; see CBS, http://www.cbs.gov.il/publications17/local_authorities15_1683/pdf/106_4000.pdf.
5. See <https://www.ynet.co.il/articles/0,7340,L-4793206,00.html>.
6. See <https://www.haifa.ac.il/index.php/en/2012-12-16-11-30-12/welcome-to-the-university-of-haifa>.
7. See CBS, http://www.cbs.gov.il/publications17/local_authorities15_1683/pdf/194_7300.pdf.
8. See Appendix A in the supplemental data online.
9. See Appendix B in the supplemental data online.
10. Research approved by the Ben Gurion University of the Negev Ethical Committee (approval number 1465-1).
11. When interviewees prefer not to reveal their names, we refer to them by the reference: ‘interviewee [number]’.
12. Tsofen is a non-profit organization supporting high-tech ventures in the Arab community; see <http://www.tsofen.org/>.
13. Since 2016 for Arabs whose firms are in the earliest stages of development, the IIA offers beneficial conditions: instead of 50%, minorities can receive 75% of the approved budget; see <https://innovationisrael.org.il/rndfund>.
14. See https://www.cbs.gov.il/he/mediarelease/DocLib/2019/223/06_19_223b.pdf; and the 2020 Report of the Information and Research Center of the Knesset,

https://fs.knesset.gov.il/globaldocs/MMM/50a5e8b2-f2f1-ea11-8119-00155d0af32a/2_50a5e8b2-f2f1-ea11-8119-00155d0af32a_11_16312.pdf.

15. Israel’s largest bank.

16. Self-calculated from the IVC Database.

ORCID

Mor Shilon  <http://orcid.org/0000-0003-3053-871X>

REFERENCES

- Ali, N. (2013). *Representation of Arab citizens in the institutions of higher Education in Israel*. The Association for the Advancement of Civic Equality.
- Asheim, B. T. (2019). Smart specialisation, innovation policy and regional innovation systems: What about new path development in less innovative regions? *Innovation: The European Journal of Social Science Research*, 32(1), 8–25. <https://doi.org/10.1080/13511610.2018.1491001>
- Avnimelech, G., & Schwartz, D. (2009). Structural transformation of regional venture capital industry: Evidence from Israel. *Innovation: Management, Policy & Practice*, 11(1), 60–73. <https://doi.org/10.5172/impp.453.11.1.60>
- Balland, P. A., Boschma, R., Crespo, J., & Rigby, D. L. (2019). Smart specialization policy in the European Union: Relatedness, knowledge complexity and regional diversification. *Regional Studies*, 53(9), 1252–1268. <https://doi.org/10.1080/00343404.2018.1437900>
- Bečić, E., & Švarc, J. (2015). Smart specialization in Croatia: Between the cluster and technological specialization. *Journal of the Knowledge Economy*, 6(2), 270–295.
- Benner, M., Bieringer, L., Knaupp, M., Wittemaier, J., & Wruck, A. (2016). *Towards a smart specialization strategy for Haifa, Israel. Report on a student research project at Heidelberg University*. Institute of Geography, Heidelberg University.
- Carayannis, E. G., & Rakhmatullin, R. (2014). The quadruple/quintuple innovation helixes and smart specialisation strategies for sustainable and inclusive growth in Europe and beyond. *Journal of the Knowledge Economy*, 5(2), 212–239. <https://doi.org/10.1007/s13132-014-0185-8>
- Cooke, P., Uranga, M., & Etxebarria, G. (1998). Regional systems of innovation: An evolutionary perspective. *Environment and Planning A: Economy and Space*, 30(9), 1563–1584. <https://doi.org/10.1068/a301563>
- Cope, J. (2005). Toward a dynamic learning perspective of entrepreneurship. *Entrepreneurship Theory and Practice*, 29(4), 373–397. <https://doi.org/10.1111/j.1540-6520.2005.00090.x>
- Creswell, J. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Sage.
- Drori, I., & Lerner, M. (2002). The dynamics of limited breaking out: The case of the Arab manufacturing businesses in Israel. *Entrepreneurship & Regional Development*, 14(2), 135–154. <https://doi.org/10.1080/08985620110112619>
- Fitjar, R. D., & Rodríguez-Pose, A. (2013). Firm collaboration and modes of innovation in Norway. *Research Policy*, 42(1), 128–138. <https://doi.org/10.1016/j.respol.2012.05.009>
- Foray, D. (2014). From smart specialisation to Smart Specialisation policy. *European Journal of Innovation Management*, 17(4), 492–507. <https://doi.org/10.1108/EJIM-09-2014-0096>
- Foray, D. (2015). *Smart specialisation: Opportunities and challenges for regional innovation policy*. Routledge.
- Foray, D. (2018). Smart specialisation strategies and industrial modernisation in European regions—theory and practice. *Cambridge Journal of Economics*, 42(6), 1505–1520.

- Foray, D., David, P. A., & Hall, B. H. (2011, November). *Smart specialization. From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation* (Working Paper). MTEI.
- Geddes, A., & Scholten, P. (2016). *The politics of migration and immigration in Europe* (2nd ed.). Sage.
- Gelbman, A., & Laven, D. (2016). Re-envisioning community-based heritage tourism in the old city of Nazareth. *Journal of Heritage Tourism*, 11(2), 105–125. <https://doi.org/10.1080/1743873X.2015.1044993>
- Goldstein, T. (2011, March 30). *Abu-Startup: Arab high-tech blooms in the Galilee*. <https://www.ynet.co.il/articles/0,7340,L-4048406,00.html>. [in Hebrew]
- Harrison, R. T., & Leitch, C. M. (2005). Entrepreneurial learning: Researching the interface between learning and the entrepreneurial context. *Entrepreneurship Theory and Practice*, 29(4), 351–371. <https://doi.org/10.1111/j.1540-6520.2005.00089.x>
- Hassink, R., & Marques, P. (2016). *The regional innovation paradox revisited. Routledge handbook of politics and technology*. Routledge.
- Hausmann, R., & Rodrik, D. (2002). *Economic development as self-discovery* (Working Paper Series WP No. 8952). National Bureau of Economic Research (NBER).
- Inter-Agency Task Force on Israeli Arab Issues. (2018). *Arab citizens' integration into Israeli high-tech: Achievements and emerging issues* (August). <https://www.iataskforce.org/sites/default/files/resource/resource-1630.pdf>
- Janger, J., Schubert, T., Andries, P., Rammer, C., & Hoskens, M. (2017). The EU 2020 innovation indicator: A step forward in measuring innovation outputs and outcomes? *Research Policy*, 46(1), 30–42. <https://doi.org/10.1016/j.respol.2016.10.001>
- Karo, E., & Kattel, R. (2015). Economic development and evolving state capacities in Central and Eastern Europe: Can 'smart specialization' make a difference? *Journal of Economic Policy Reform*, 18(2), 172–187. <https://doi.org/10.1080/17487870.2015.1009068>
- Khattab, N., & Miaari, S. (2013). On the reserve bench: Palestinian employees in Israel. In N. Khattab & S. Miaari (Eds.), *Palestinians in the Israeli labor market* (pp. 11–36). Palgrave Macmillan.
- Komninou, N., Musyck, B., & Iain Reid, A. (2014). Smart specialisation strategies in south Europe during crisis. *European Journal of Innovation Management*, 17(4), 448–471. <https://doi.org/10.1108/EJIM-11-2013-0118>
- Kroll, H. (2015). Efforts to implement smart specialization in practice—leading unlike horses to the water. *European Planning Studies*, 23(10), 2079–2098. <https://doi.org/10.1080/09654313.2014.1003036>
- Landabaso, M., & Foray, D. (2014). Guest editorial on research and innovation strategies for smart specialisation in Europe: Theory and practice of new innovation policy approaches. *European Journal of Innovation Management*, 17(4), 378–389. <https://doi.org/10.1108/EJIM-08-2014-0093>
- Malecki, E. J. (2009). Geographical environments for entrepreneurship. *International Journal of Entrepreneurship and Small Business*, 7(2), 175–190. <https://doi.org/10.1504/IJESB.2009.022805>
- McCann, P., & Ortega-Argilés, R. (2015). Smart specialization, regional growth and applications to European Union cohesion policy. *Regional Studies*, 49(8), 1291–1302. <https://doi.org/10.1080/00343404.2013.799769>
- McCann, P., & Ortega-Argilés, R. (2019). 2. Perspectives on smart specialisation policies in lagging regions. *Regional Studies Policy Impact Books*, 1(2), 17–27. <https://doi.org/10.1080/2578711X.2019.1621098>
- Morgan, K. (2013). The regional state in the era of smart specialisation. *EKONOMIAZ. Revista Vasca de Economía*, 83((02|2)), 103–126.
- Morgan, K., & Marques, P. (2019). The public animateur: Mission-led innovation and the 'smart state' in Europe. *Cambridge Journal of Regions, Economy and Society*, 12(2), 179–193. <https://doi.org/10.1093/cjres/rsz002>
- Muscio, A., Reid, A., & Rivera Leon, L. (2015). An empirical test of the regional innovation paradox: Can smart specialisation overcome the paradox in Central and Eastern Europe? *Journal of Economic Policy Reform*, 18(2), 153–171. <https://doi.org/10.1080/17487870.2015.1013545>
- Organisation for Economic Co-operation and Development (OECD). (2013). *Innovation-driven growth in regions: The role of smart specialisation* (OECD Science, Technology and Industry Policy Papers No. 12).
- Organisation for Economic Co-operation and Development (OECD). (2016). *SME and entrepreneurship policy in Israel* (OECD Studies on SMEs and Entrepreneurship).
- Oughton, C., Landabaso, M., & Morgan, K. (2002). The regional innovation paradox: Innovation policy and industrial policy. *The Journal of Technology Transfer*, 27(1), 97–110. <https://doi.org/10.1023/A:1013104805703>
- Papamichail, G., Rosiello, A., & Wiold, D. (2019). Capacity-building barriers to S3 implementation: An empirical framework for catch-up regions. *Innovation: The European Journal of Social Science Research*, 32(1), 66–84. <https://doi.org/10.1080/13511610.2018.1537844>
- Potter, J., & Smith, H. L. (2019). 4. Smart specialisation in Eastern Europe: Insights from two lagging Polish regions. *Regional Studies Policy Impact Books*, 1(2), 43–53. <https://doi.org/10.1080/2578711X.2019.1621100>
- Rodríguez-Pose, A., & Crescenzi, R. (2008). Mountains in a flat world: Why proximity still matters for the location of economic activity. *Cambridge Journal of Regions, Economy and Society*, 1(3), 371–388. <https://doi.org/10.1093/cjres/rsn011>
- Rodríguez-Pose, A., & Storper, M. (2006). Better rules or stronger communities? On the social foundations of institutional change and its economic effects. *Economic Geography*, 82(1), 1–25. <https://doi.org/10.1111/j.1944-8287.2006.tb00286.x>
- Santoalha, A. (2019). Technological diversification and smart specialisation: The role of cooperation. *Regional Studies*, 1–15. <https://doi.org/10.1080/00343404.2018.1530753>
- Schneider, A. (2018). *Arab citizens' integration into Israeli high-tech: Achievements and emerging issues, inter-agency task force on Israeli Arab issues*.
- Schnell, I., & Sofer, M. (2006). Obstacles to economic development in the Palestinian economy in Israel. In S. Hasson, & M. Karayanni (Eds.), *Barriers to equality: The Palestinians in Israel* (pp. 204–212). Floersheimer Institute for Policy Studies. [in Hebrew]
- Seif, I. (2019). *The integration of Arab society in the high-tech industry in Israel* (Internal Report provided to the Department of Economics by Sapic Academic College).
- Sofer, M., & Schnell, I. (2000). The restructuring stages of Israeli Arab industrial entrepreneurship. *Environment and Planning A: Economy and Space*, 32(12), 2231–2250. <https://doi.org/10.1068/a3373>
- Spigel, B. (2017). Bourdieu, culture, and the economic geography of practice: Entrepreneurial mentorship in Ottawa and Waterloo, Canada. *Journal of Economic Geography*, 17(2), 287–310. <https://doi.org/10.1093/jeg/lbw019>
- Tripp, M., Zukauskaitė, E., & Healy, A. (2019). Shaping smart specialization: The role of place-specific factors in advanced, intermediate and less-developed European regions. *Regional Studies*, 1–13. <https://doi.org/10.1080/00343404.2019.1582763>
- Vallance, P., Blažek, J., Edwards, J., & Květoň, V. (2018). Smart specialisation in regions with less-developed research and innovation systems: A changing role for universities? *Environment and Planning C: Politics and Space*, 36(2), 219–238. <https://doi.org/10.1177/2399654417705137>
- Von Tunzelmann, N. (2009). Competencies versus capabilities: A reassessment. *Economia Politica*, 26(3), 435–464. [10.1428/30999](https://doi.org/10.1428/30999).