How do you design an experimental economy?

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Abstract

How do you design an organization, an innovation system made up of multiple organizations, or a whole economy to encourage entrepreneurial experimentation?

We know a good deal about entrepreneurial experimentation when it comes to individuals and firms (organizations), much less concerning innovation systems and even less for whole economies. The purpose of the paper is (1) to briefly examine the organization of entrepreneurial activity at three of the world's largest and most innovative companies (Amazon, Apple, and Google), and (2) to explore the extent to which the findings at the corporate level can be applied at the more general innovation system (meso) and economy (macro) levels.

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Introduction

Innovation is one of the main drivers of economic growth. Innovations – new combinations – are the result of entrepreneurial activity which is a form of experimentation. (Dahlstrand et al., 2008) While there is a large literature on innovation and entrepreneurial activity, considerably less has been written about entrepreneurial experimentation and even less about how to organize it. How do you design an organization, an innovation system made up of multiple organizations, or a whole economy to encourage entrepreneurial experimentation?

An experimentally organized economy may be defined as one whose culture and institutional infrastructure facilitate and support innovation in all phases (creation of new knowledge, selection of viable ideas, and scaling up of commercial activity) and entrepreneurial activity through experimentation at all levels – individual, organizational, and societal.

We know a good deal about entrepreneurial experimentation when it comes to individuals and firms (organizations), less so for innovation systems and even less for whole economies. This paper addresses experimental organization at the organizational, systems, and economy level. It is part of a larger project on the Experimentally Organized Economy currently under way at CIRCLE. The state of our knowledge about experimental individuals is addressed in other parts of the project.

At the level of organizations or firms there is not much in the literature that addresses experimentation per se, but there is ample material on innovation, especially at the project level. The purpose of this paper is (1) to briefly examine the organization of entrepreneurial activity at three of the world's largest and most innovative companies, and (2) to explore the extent to which the findings at the corporate level can be applied at the more general innovation system (meso) and economy (macro) levels.

Organization of innovation at the corporate (micro) level

Apple, Amazon, and Google are three of the world's largest and most innovative companies. They can be viewed as corporate innovation systems. What can we learn by examining how these companies organize their innovative activities?

Amazon, Apple, and Google have much in common when it comes to organization of innovation. All three emphasize culture, not organization, as primary. Apple says that its "commitment to innovation is cultural, not process driven." Google states that "company culture and innovation can't be separated." At Amazon, "innovation is a function of architecture and organization amplified to the power of mechanisms and culture." Architecture means creating a structure that supports rapid growth and change; organization involves letting small and empowered teams own what they create, and mechanisms refer to "encoding behaviors into our DNA that facilitate innovative thinking." (Schmidt et al., 2014; https://innovarsity.com/coach/bp_innovation_strategies_apple.html; https://innovarsity.com/coach/bp_product_design_apple.html; https://chiefmartec.com/2019/07/want-innovate-like-amazon-heres-formula/)

At all three companies, culture starts with hiring the right people - Google calls them 'smart creatives' - (after careful screening) and then giving them freedom to Think Big and take risks and allowing them to fail (and fail fast!) while learning from their failures. The companies support their employees with a belief system that includes customer obsession rather than competitor focus (Google says “True innovation happens when you try to improve something by 10 times rather than by 10 %.”) Focusing on the competition leads to incremental, not radical change. Quality is regarded as being more important than quantity. Focus on the long term rather than the short term is also part of the culture (Schmidt et al., 2014).

Instead of any particular organization or structure, these companies rely on some basic principles. Apple uses a strategy to match the ‘dream products’ of senior managers with ideas from design teams. Every week, design teams have two meetings: a creative meeting where people brainstorm, think freely, and forget about constraints, and a production meeting where the designers and engineers are required to nail everything down, to work out how their ideas might actually be implemented.

All three companies spend heavily on in-house R&D but rely also on Open Innovation, sourcing ideas from anywhere, both inside and outside the firm. Collaboration is encouraged both within the company and with people outside. Google uses the 70/20/10 model in which 70 % of projects are dedicated to its core business, 20 % are related to the core business, and 10 % are unrelated to the core business. Apple uses a “10 to 3 to 1″ approach, a sort of artificial natural-selection mechanism that kills off the weak and only lets the strongest ideas rise to the top. Apple designers give themselves room to design without restriction and come up with 10 entirely different mockups of any new feature. Later they whittle that number to three, spend more months on those three and then finally end up with one strong decision.

In addition to these experimental processes that these companies use in their internal innovation, another common feature is that they often acquire other companies to complement their existing products and to expand into new business areas. This may be viewed as a form of experimentation in which smaller companies, often startups, do the early product development or even launch into the market, and then the giant company with deep pockets and superior market reach can ramp up production, expand sales dramatically, and achieve network effects.

Innovation system (meso) level

Can the ideas and principles governing innovation – corporate innovation systems - at these large firms be applied to innovation systems in general, systems that involve multiple organizations? As suggested above, it is possible to view these companies as innovation systems, with one fundamental difference: Amazon, Apple, and Google are private companies with strong central leadership and decision making, which innovation systems typically do not have. These three companies are also “technology companies” that rely heavily on intellectual property, digital information, and the Internet. Nevertheless, let's explore the idea.

What are some examples of experimental innovation systems that would be suitable for comparison? The regional clusters that include Google and Apple in the San Francisco Bay Area and Amazon and Microsoft in the Seattle area come to mind immediately. The life science industry clusters in San Francisco and Boston and elsewhere are also possible candidates. Technical progress in life science is experimental in nature; the mapping of the human genome has opened up a vast new arena where discovery is often made through experimentation and inductive (exploratory) rather than deductive reasoning. (It is interesting that in many cases new products can reach their market potential only through collaboration with or acquisition by existing large pharmaceutical companies.)

An innovation system consists of actors, networks and institutions working together to generate, diffuse, and utilize technology. The key actors in the system are entrepreneurs and the key activity is creation and sharing of knowledge and competence (Carlsson & Stankiewicz 1991).

As articulated by Bergek et al. (2008), there are seven key functions of innovation systems:

- Knowledge development and diffusion
- Influence on the direction of search
- Entrepreneurial experimentation
- Market formation (actual market development and what drives market formation)
- Legitimation (social acceptance and compliance with relevant institutions).
- Resource mobilization
- Development of positive externalities (e.g. knowledge spillovers)

Each innovation system has its own characteristics and configuration in terms of how each of these functions is carried out and coordinated, but all functions have to be fulfilled for the system to achieve its potential.

How are these functions carried out at Apple, Google, and Amazon?

Knowledge development is done through in-house R&D in combination with Open Innovation and acquisition. Knowledge is diffused within the companies through internal and external collaboration in loosely organized ad hoc groups. The matching of corporate strategy with new ideas that come up from individuals or groups influences the direction of search and diffuses ideas throughout the organization. The freedom of 'smart creatives' to use 20% of their time to Think Big (rather than on specific projects) and the application of 70/20/10 rules are important parts of a corporate culture that encourages entrepreneurial experimentation. Focus on the long term and on the customer (rather than revenue), combined with the tolerance of failure (as long as it is fast, lessons are learned, and the knowledge gained is redeployed in subsequent projects) provides legitimacy within the company. The sheer size of the companies and their lobbying power help achieve legitimation in the political and institutional arena. The global reach of these large companies provides immediate access to the global market, and their huge financial assets and control of global supply chains make abundant resources available. Knowledge spillovers and other positive externalities are encouraged through open innovation.

Thus, it is clear that Amazon, Apple, and Google cover all the functions required in well-functioning innovation systems. One big difference between these corporate systems and others, of course, is that they have central coordination of all functions through their corporate governance structure that simply does not exist in the same form in innovation systems in general. They also have unmatched financial resources, technical competence, marketing capability, and global reach. Perhaps the most important difference is that they are founded on a culture of innovation that permeates everything they do, from whom they hire, how they encourage and support collaboration and risk-taking, to how rapidly they make and enforce decisions ("Launch first," etc.).

Nevertheless, it is clearly also true that there are innovation systems that have achieved success without formal central decision-making. Let's call it orchestration. It is worth thinking about how orchestration is achieved in successful innovation systems in general. Culture is a different matter. In the absence of common approaches in selecting and hiring 'smart creatives' that foster creativity and innovation, it may not be possible to replicate the culture that makes Apple, Google, and Amazon who they are. Culture may be peculiar to each firm or actor in any given system and not transferable to the system as a whole. This is an idea to be further explored.

In terms of orchestration, it is instructive to compare the evolution of the biotech clusters in the Boston/Cambridge and San Francisco Bay areas in the 1980s and 90s and who led the cluster formation. In the Boston area, the dominant players in the emerging network in the beginning were public research organizations such as Harvard, MIT, Tufts, and Massachusetts General Hospital. There were only a small number of ties between biotech firms and between biotech firms and local VC firms. These ties grew as the network expanded during the 1990s and dominated the commercial ties at the end of the period. Public science formed the foundation for commercial application. Early in its evolution, the Boston biotechnology community was linked together by shared connections to academic research; research organizations were the orchestrators.

By contrast, the formation of the biotech innovation system in the San Francisco Bay area was orchestrated by venture capital firms:

> [T]he Bay Area community was composed entirely of ties linking DBFs [dedicated biotechnology firms] to local VC firms. Where the stability and technical diversity of Boston PROs [public research organizations] anchored that network and fostered a more open technological trajectory…, the Bay Area relied heavily on the prospecting and matchmaking efforts of venture investors. Later years witnessed the increasing importance of VCs, a smattering of ties involving PROs, and – most importantly – dramatic growth in DBF-DBF connections… Both Boston and the San Francisco Bay Area evolved from dependence on a non-DBF organizational form to a state where significant portions of the network were made coherent by direct connections among science-based biotechnology firms. In other words, similar endpoints in the evolution of the networks were reached through different routes. While both relied on the inclusion of organizations different from biotechnology firms, Boston was anchored in the public sector, whereas the Bay Area was dominated by venture capitalists." (Owen-Smith & Powell, 2006, pp. 67- 68)

The aircraft industry provides another example. The industry consists of several large aerospace clusters typically made up of one or several OEMs (original equipment manufacturers) surrounded by hundreds of small and medium-sized suppliers of components and parts. There are two types of suppliers: higher-tier lead suppliers that deal directly with several OEMs and lower-tier suppliers that usually deal with the higher-tier suppliers, not directly with the OEMs. The higher-tier suppliers are usually located outside the local cluster, often overseas. Aerospace regions tend to specialize in different parts of the value chain. They manufacture high-value products in batches from a few hundred to several thousand items. There are civilian aircraft assembly clusters (such as in Seattle, Montreal, and Toulouse) and engines clusters (such around General Electric's engine plants in Cincinnati, Ohio, and Lynn, Massachusetts). With Boeing as a major assembler, Seattle is specialized in engineering and production of large commercial aircraft. Toulouse (France) is the major production site of Airbus and ATR. (Niosi & Zhegu, 2005) In each of these clusters the large OEMs are the orchestrators of activities (Carlsson 2013).

Yet another example is the semiconductor industry. The transistor was invented at Bell Labs in New Jersey around 1950 by a team led by William Shockley. The new technology was commercialized in Silicon Valley after Shockley re-located there, attracted in part by the efforts of Fred Terman, the Dean of Engineering at Stanford University. Terman was trying to build Stanford's research capabilities through federal funding of the doctoral program in engineering and through close alliances with industry. There were several electronics companies already in place, including Litton Engineering Laboratories, Hewlett-Packard, and Varian Associates. There were also important institutions such as Stanford Industrial Park (founded in the late 1940s) and Stanford Research Institute (1950s), both envisioned and initiated by Terman. The formation of the Silicon Valley semiconductor cluster was orchestrated by Fred Terman (Carlsson 2013).

Society/economy (macro) level

In the literature on innovation systems at the corporate and sub-national levels, the question of the origin of the system seldom comes up. The domain of the system is given (exogenous); the analysis typically focuses on structure and functions, not on how systems emerge. But when we move to the national level, the domain is more uncertain, endogenous, and sometimes determined in a political context. It may be useful to think of architecture and design which require coherent human (entrepreneurial) thinking and action rather than structure and function which are the results of such activity.

The study of an experimentally organized economy (EOE) requires evolutionary theory. The EOE rests on the assumption of an enormous set of technical possibilities. The choice of which combination of technical possibilities (domain) to exploit is not given; it is endogenous. Given that the set of technical possibilities is extremely large, non-transparent and largely unknown, the traditional strategies of optimization or maximization are simply inadequate. Outcomes are not merely uncertain; they are unpredictable. The only way forward is through experimentation: making educated guesses, based on both prior knowledge and intuition, as to what new combinations might work. It is a process of discovery. Once a new discovery is made, it has to be tested – i.e., compared to existing or alternative solutions – first in the laboratory (for technical and financial feasibility) and then in the market. If it survives the test (i.e., if it is selected), it must be scaled up from experimental entry to industrial scale.[1]

While each system is unique, there are some common features (Carlsson 2012).

1. Innovation systems don't come out of nowhere. There is something to start with, some starting point in the form of pre-existing conditions, a local or regional agglomeration of actors in a market or technological domain, some form of path dependence that creates a fertile environment.
2. Some triggering event occurs, a discovery (an invention, perhaps) or a new idea. The new idea may be the result of a spillover from one domain to another (a new combination), or application of technology to a new domain. Sometimes the trigger may be a political decision.
3. This event triggers an entrepreneurial experiment (spark). Someone realizes the potential of the new idea and takes action – launches a new product, starts a new company, links up with another company or actor, or otherwise implements a new combination. New entrants may be attracted.

[1] The EOE has been modeled at the macro (economy) level: Eliasson 1991, Carlsson & Eliasson 2003, Eliasson, Johansson & Taymaz, 2004.

4. Whether or not the new idea takes hold depends on the ability (and luck!) of the entrepreneur(s) to secure the necessary knowhow, finances, technical (labor) skills, and management competence. (This is where large corporations have an advantage.) Collaboration, partnerships, open innovation, and open sourcing are vehicles to pool and coordinate resources. The greater the openness, the greater the absorptive capacity of the environment (often in the form of sharing or spillovers of knowledge), and the greater the chances of success.

5. Strategy is formulated by competing individual actors within the system, not by a central decision maker at the system level. However, strategy formulation may be orchestrated at the system level. Successful experiments attract followers; common assumptions and expectations eventually emerge; and individual strategies become more aligned. At the system level, the strategy emerges over time as it becomes clear what the desired goal of the system is and how it can be achieved.

As we move the analysis to the macro level, what are some examples of experimentally organized societies? What are their characteristics?

The best example that comes to mind is Israel, demonstrated by its extraordinary success in high technology such as ICT and biotech.

Israel's High Tech Economy

Entrepreneurial activity in Israel has been studied extensively. See for example Singer & Senor (2011). Between 1999 and 2014, Israelis started 10,185 companies. Half of those companies were still in operation in 2016, and 2.6% had annual revenues of over $100 million. After the U.S. and China, Israel is the most represented country on NASDAQ. Over 300 multinationals including Facebook and Amazon have set up R&D labs in the country (Yin 2016, 2017). Many of Israel's high tech businesses are in information and communication technology (ICT) and biotechnology.

It can be demonstrated that Israel has achieved success in each of the seven functions of innovation systems.

Knowledge development and diffusion

Israel invests 4.3 % of its GDP in R&D (the highest in the world), with 30 % of it being channelled through its universities. Perhaps even more importantly, Israeli universities have taken the lead in commercializing their research output. Starting with the Weizmann Institute in 1959, Israeli universities have created their own technology transfer companies, which either patent the research and license them out or start new companies themselves (Yin 2016). Yissum, the technology transfer company of the Hebrew University of Jerusalem, has over 9,300 patents and 110 spin-offs to its name. Researchers are evaluated based on their patent portfolios for staff positions or promotions. (Yin 2016)

Much of Israel's R&D strength can be attributed to its military. Military R&D in Israel grew rapidly in the 1960s and 1970s, accounting for 30% of all military expenditures. Aided by industrial grants from the government, some enterprising individuals began transferring defense innovations to civilian projects. For example, pattern recognition technologies were applied to identify defects in manufacturing, while data storage expertise was used to invent the USB flash drive… Israel's military needs have led to cutting edge technologies in machine learning and vision. Many technology firms have built their offices around Israel's military bases to take advantage of the spillover effects from defense-related R&D. (Yin 2016)

In recent years, an increasing number of companies (including Microsoft) have adopted open innovation in Israel. They work with startups and mentor entrepreneurs – with no strings attached. Even though these companies might acquire the startups eventually, their main goal is to integrate into Israel's innovation ecosystem and understand the latest developments in their fields. (Yin 2017)

Influence on the direction of search

The military has obviously played an important role in influencing the direction of R&D in Israel. Another major player in the tech and innovation ecosystem is the Israel Innovation Authority (formerly Office of Chief Scientist), a central government agency responsible for fostering innovation in various industries (Yin 2017).

Entrepreneurial experimentation:

There is a strong bias towards action, driven in large part by defense needs. As a result, Israeli innovators tend to move quickly to execution after coming up with an idea. Often, it begins with building a simple proof of concept prototype, followed by constant iteration in a lean and cost-efficient manner. In the process, a few radically innovative products emerge, sometimes disrupting entire industries.

Market formation

With a population of 8.5 million, Israel’s domestic market is also too small to generate sufficient internal demand. To bypass such geopolitical isolation, many Israeli companies focus on high-tech industries such as software and Internet where scalability is not restricted by borders or transportation costs. They are aided in their efforts by the fact that many companies are acquired by large multinational companies that can get their products out on the global market quickly and that other startups are backed by venture capital firms that are well connected to the American capital market (including NASDAQ).

Resource mobilization

The inflow of new immigrants has been a key engine of Israel’s economic vitality. In the 1990s, close to a million citizens from the former USSR moved to Israel. Many came with strong science and engineering backgrounds and contributed directly to Israel’s high-tech boom. Backed by their diverse and fresh perspectives, the new Israelis demonstrated tremendous drive and risk-taking appetite. They were willing to do things differently and more efficiently, with few conventions to hold them back (Yin 2017).

A key factor of Israel’s innovation ecosystem is the strong interconnections among its people, which promotes collaboration and exchange of ideas. Much of it stems from shared army experiences, given every Israeli goes through the two or three-year mandatory military service. (Yin 2017)

Another factor is the geographic concentration of institutions such as universities, multinationals and startups. People work alongside and together with each other. Many constantly shuffle between academia, military, entrepreneurship, R&D, policymaking and venture capital, sometimes wearing several hats at once (Yin 2017).

Legitimation

In this function, too, the ties of Israeli companies to multinational firms help them overcome many regulatory and other hurdles. The approval by the U.S. Food and Drug Administration (FDA) of many Israeli biotech products is an indication of legitimation.

Development of positive externalities

Israel is a living example of turning weaknesses into strengths and triumphing over the odds. It is limited by its small size, precarious geopolitical environment, and lack of natural resources. Israel’s land mass is smaller than New Jersey, but it is home to people from over 70 nationalities. The migration of a Jewish diaspora brought with it diverse cultures, perspectives, and skillsets. But Israel has managed to turn these weaknesses into strengths. Israel invested heavily in education to take advantage of the intellectual capacity of its people. It was able to overcome its lack of freshwater and become a leader in desert agriculture by developing world-class technologies in drip irrigation and desalination (Yin 2017).

Thus, the Israeli innovation system scores high in all these dimensions. And yet, that is probably only part of the explanation of the country's success in high tech industry. As already indicated, an important part is due to the country's military and the culture it has created.

The military has served as an incubator: a large proportion of Israeli youth are drafted into mandatory military service for two or three years. Although the Israeli Defense Forces (IDF) maintains a relatively small standing force, it leverages its fighting capabilities through training and technology. To this end, it maintains a rigorous sorting process to place conscripts in divisions where they are most needed. Since IDF essentially has its pick of the best and brightest young minds in the country, it takes care to draft the most promising high schoolers into specialized elite units. Candidates are examined for their leadership, creativity, communication skills and speed of learning. The cyber division of the IDF Intelligence corps is considered the elite unit. It uses a rigorous screening process in hiring: several rounds of standardized tests and a six-day selection test involving problem solving and disaster management exercises. As an example, having been selected to train as a pilot for the Israeli Air Force and after six years as a pilot and obtaining a doctorate in computer science from Tel Aviv University, one person began his career as a research scientist, first at Weizmann Institute and later at Bell Laboratories. His name appears in thirty patents and a hundred journal papers (Yin 2016). This example may not be typical, but it illustrates the importance of careful recruiting in creating a culture and ethos that can permeate the entire ecosystem.

Implications for Public Policy and Future Research

This paper is part of a larger project on the Experimentally Organized Economy. This preliminary survey indicates a gap in the literature concerning design of entrepreneurial experimentation at the macro level. In subsequent papers we will further examine the empirical literature on the organization of innovation and entrepreneurial activity at the organizational and system levels in order to explore the following questions: How do you create a culture that supports innovation and entrepreneurial experimentation? Can the lessons from successful large organizations such as Google be applied in or translated to other contexts - meso (systems) and macro (society) level? How can these functions be executed in successful societies/systems/organizations? What are the infrastructure/institutional environment /coordinating mechanisms at each level?

REFERENCES

Organizational level

Apple's Innovation Strategies, 2019. https://innovarsity.com/coach/bp_innovation_strategies_apple.html.

Apple's Design Process, 2019. https://innovarsity.com/coach/bp_product_design_apple.html.

Camerer, Colin F. & Weber, Roberto A., 2013. Experimental Organizational Economics. In Gibbons, R.S. and Roberts, J. eds., 2013. *The handbook of organizational economics*. Princeton University Press, pp 213-

Chesbrough, H., Kim, S., & Agogino, A., 2014. Chez Panisse: Building an Open Innovation Ecosystem. *California Management Review*, 56 (4), 144-171

Bogers, M., Chesbrough, H. & Moedas, C., 2018. Open Innovation: Research, Practices, and Policies. *California Management Review*, 60 (2), 5-16.

Bogers, M., Chesbrough, H., Heaton, S. and Teece, D.J., 2019. Strategic Management of Open Innovation: A Dynamic Capabilities Perspective. *California Management Review* 62(1), 77-94

Chesbrough, H.W. & Appleyard, M.M., 2007. Open Innovation and Strategy, *California Management Review*, 50 (1), 57-76

Donaldson, L., 1990. The Ethereal Hand: Organizational Economics and Management Theory. *Academy of Management Review*, 15 (3), 369-381

Felin, T. and Powell, T.C., 2016. Designing Organizations for Dynamic Capabilities. *California Management Review*, 58 (4), 78-96

Keidel, R.W., 1994. Rethinking Organizational Design. *Academy of Management Executive*, 8 (4), 12-28

Schmidt, E., Rosenberg, J. and Eagle, A. 2014. *How Google Works* (New York, NY: Grand Central Publishing)

Teece, D.J., 1996. Firm Organization, Industrial Structure, and Technological Innovation. *Journal of Economic Behavior & Organization*, 31 (2), 193-224.

Thomke, S. H., 1998. Managing Experimentation in the Design of New Products. *Management Science*, 44 (6), 743-762

Thomke, S. H., 2003. *Experimentation Matters: Unlocking the Potential of New Technologies for Innovation.* Harvard Business School Press.

Want to Innovate Like Amazon? Here's Their Formula, 2019. https://chiefmartec.com/2019/07/want-innovate-like-amazon-heres-formula/.

System level

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A., 1008. Analyzing the Functional Dynamics of Technological Innovation Systems: A Scheme of Analysis. *Research Policy*, 37(4), 407-429.

Carlsson, B. & Stankiewicz, S., 1991. On the Nature, Function, and Composition of Technological Systems. *Journal of Evolutionary Economics,* 1 (2), 93-118.

Dahlstrand ,Å., Andersson, M. & Carlsson, B., 2019. Entrepreneurial Experimentation: A Key Function in Entrepreneurial Systems of Innovation. *Small Business Economics*, (53), 591-610.

Owen-Smith, J. and Powell, W., 2006. "Accounting for Emergence and Novelty in Boston and Bay Area Biotechnology. Braunerhjelm, P. & Feldman, M. (eds.). *Cluster Genesis: Technology-Based Industrial Development*, Oxford: Oxford University Press, 61-83.

Niosi, J. & Zhegu, M., 2005. "Aerospace Clusters: Local or Global Knowledge Spillovers?" *Industry and Innovation*, 12(1), 1-25

Economy level

Carlsson, B. & Eliasson, G., 2003. Industrial Dynamics and Endogenous Growth, *Industry and Innovation*, Vol.10, No. 4, pp. 435-455.

Carlsson, B., 2012. Entrepreneurship and Public Policy in Emerging Clusters. in A. Rickne, S. Laestadius and H. Etzkowitz (eds.), *Innovation Governance in an Open Economy,* New York: Routledge, 251-274.

Carlsson, B., 2013. Knowledge Flows in High-Tech Industry Clusters: Dissemination Mechanisms and Innovation Regimes," in E.S. Andersen and A. Pyka (eds.), *Long term economic development: Demand, finance, organization, policy and innovation in a Schumpeterian perspective*, Springer Verlag, 191-222.

Eliasson, G., 1991. Modeling the experimentally organized economy: Complex dynamics in an empirical micro-macro model of endogenous economic growth. *Journal of Economic Behavior & Organization*, 16(1-2), 153-182.

Eliasson, G., Johansson, D. and Taymaz, E., 2004. Simulating the new economy. *Structural Change and Economic Dynamics*, 15(3), 289-314.

Senor, D. and Singer, S., 2011. *Start-up nation: The story of Israel's economic miracle*. Random House Digital, Inc.

Yin, D., 2016. Secrets to Israel's Innovative Edge. *Forbes*. Disponível em: https://www. forbes. com/sites/davidyin/2016/06/05/secrets-to-israels-innovativeedge.

Yin, D., 2017. What Makes Israel's Innovation Ecosystem So Successful. *Forbes Asia*, pp.1-7.