

. . . The secret, then, of Israel's success is the combination of classic elements of technology clusters with some unique Israeli elements that enhance the skills and experience of individuals, make them together more effective as teams, and provide tight and readily available connections within an established and growing community. For outside observers, this raises a question: If the Israeli "secret sauce" is so unique to Israel, what can other countries learn from it?

**Dan Senor and Saul Singer, *Start-Up Nation:  
The Story of Israel's Economic Miracle***

Since the late 1980s, the Israeli high-tech industry has witnessed unprecedented growth. The information technology and communication (ITC) sector in particular has exhibited innovative qualities and gained a leadership position worldwide—in spite of its small size, Israel is considered a global leader in this industry. Various studies have attempted to analyze the story of the Israeli high-tech industry and its trajectory to success. Most of them have focused on the processes and conditions that led to an agglomeration of resources and infrastructure and the formation of a unique high-tech sector (see, e.g., Avnimelech 2008; Breznitz 2007; de Fontenay and Carmel 2001; Saxenian 2002). However, the history and dynamics leading to the emergence of this sector have received little attention.

This book aims to reveal the environmental and organizational processes, as well as the critical paths, that underlie the evolution, structure, and comparative advantage of Israel's high-tech industry. We do not analyze its growth as a unified process stemming from the creation of a cluster. Instead, we present a complementary view in which we argue that Israel's ITC sector evolved out of diverse organizational models of founding that were embedded in two

different institutional environments: an institutional-cooperative period that was followed by a competitive economic period.

We develop an evolutionary perspective on the development of the Israeli high-tech industry in general and on the ITC sector in particular. We do so by examining the context of inheritance and transmission of the sector's organizational characteristics while analyzing the prevailing institutional environments that represent the bedrock of its emergence and founding. Our theoretical conceptualization attends to both initial conditions and change, and uses a process-oriented mechanism to account for each. Furthermore, we predicate the evolution of the high-tech industry on its historical foundation.

As Stinchcombe (1965) asserts, initial conditions, including "the groups, institutions, laws, population characteristics and set of social relations that form the environment, have an enduring impact on industry evolution" (p. 142). This assertion implies a major challenge in explaining how the genesis of the institutional environment and the initial conditions under which key organizations were founded intertwined to create a particular momentum of growth for an entire industry.

We assert that initial conditions, socioeconomic processes, and geopolitical considerations, and the policy environment in particular, together influence the evolution of an industrial sector. They do so through the multilevel processes of inheritance and the intergenerational transmission of organizational forms, practices, routines, skills, and blueprints (see Phillips 2002, 2005). Furthermore, the evolutionary path of any industrial sector is shaped in response to the forces of competition, which affect an organization's mix and rate of change (Carroll 1984) and its corresponding entrepreneurial norms and opportunities.

The evolutionary mechanisms of competition and institutionalization dovetail with the persistent structures of organizational inheritance composed of certain practices and activities. In this perspective, both organizational and external forces are drivers of the Israeli high-tech industry's evolution. Such a comprehensive view allows us to assert the continuity between those who laid the foundation of the industry and their progenies who followed in their evolutionary path through direct inheritance structures. In the same vein, we can trace the changes in inheritance structures and processes that fostered a variety of organizational forms (Baum and Rao 2004; Stinchcombe 1968).

We first identify the origin of the founding firms in Israel's high-tech industry and their respective institutional environments; then we propose a genealogical framework for describing and analyzing the evolution of this industry.

In organizational terms, a *genealogy* is a system of affiliation among organizations that originate from the same founding parents. Because we focus on the founding process, we claim that the influence of founding parents is enduring and shapes the evolutionary trajectory of the entire genealogy. Thus, understanding the historical conditions at the founding of each genealogy is critical to our story. According to Stinchcombe (1965), the external environment at the time of founding is highly influential in shaping organizational characteristics that are imprinted with the “social resources available” (p. 168). Stinchcombe, a proponent of the imprinting perspective, explicitly contended that “organizations which are founded at a particular time must construct their social systems with social resources available” (p. 168). Once such social systems are built (in terms of structure, processes, and culture), they are maintained and further imprinted because “traditionalized forces, the vesting of interests, and the working out of ideologies may tend to preserve the structure” (p. 169).

Furthermore, founding parents of genealogies may not only constitute the potential bearers of new organizations through the spawning process (Klepper 2001)<sup>1</sup> but also be carriers of knowledge, values, and characteristics that encourage the spawning of new organizations. The assertion that progenies who found organizations rely on and learn from their parents has been widely discussed in recent literature (Klepper 2009; Baron and Hannan 2005; Burton 2001; Phillips 2002, 2005).

Our analysis of the evolutionary processes in the Israeli high-tech industry and our exploration of the industry’s historical origins provide an understanding of how specific organizational genealogies are established and evolve. The genealogies presented in this book reflect the diverse structural characteristics, values, and routines associated with founding processes. We examine the different evolutionary patterns of the genealogies and their subsequent interrelationships, which characterized the maturity of this industry. These interrelationships stem from affinities between different genealogies and increase along generations with a genealogy’s expansion. However, the different initial conditions that mark the founding of a genealogy’s ancestors reflect different patterns of inheritance—namely, the spawning process and the transfer of capabilities and knowledge from generation to generation. For successful founding and survival, a new organization can rely on a number of sources for acquiring necessary resources: its management blueprints, norms, or values (Baron and Hannan 2005; Burton, Sorensen, and Beckman 2002; Hannan and Freeman 1989, 21; Baum and Singh 1994). However, the genealogical affiliation is its primary foundation. As we argued earlier, the relevance of genealogical

evolution is twofold: in the founding of new firms and in the evolution of Israel's new high-tech communication and IT sector.

Founding parents and their incumbents carry entrepreneurial knowledge while spawning new firms through varied selection processes that tend to expand and diversify (Aldrich and Ruef 2006). A case in point is the small group of technology companies in the Silicon Valley, most notably Fairchild Semiconductor, which not only spun off numerous firms but also attracted other businesses in related technological fields and businesses (e.g., Castilla et al. 2000; Kenney 2000). The process of founding new firms is not only an issue of resource acquisition or agglomeration and clustering; it is also a genealogical progression, which relates to how founders develop entrepreneurial tendencies and acquire certain capabilities and skills that enable them to successfully launch new ventures. Consequently, our genealogical approach stresses the importance of both prenatal affiliation and heredity, both of which shape genealogical evolution through processes of selection. However, as we will demonstrate, parental affiliation does not necessarily imply that progenies are conditioned by their organizational "DNA" and indiscriminately mirror their parents. Environmental changes or selective adoption of managerial blueprints may introduce different models of founding, including different values and norms, that greatly influence the pattern of genealogical reproduction (e.g., Baum and Singh 1994; Hannan and Freeman 1989). Similar to the story of Silicon Valley, where, as mentioned, a number of genealogies descended from Fairchild Semiconductor (Rogers and Larsen 1984; Saxenian 1994), our case demonstrates that each ancestor of a genealogy spins off a "family tree" that exhibits its distinct characteristics in term of structure and reproduction pattern. The varied lines of heredity formed the entire ITC sector in Israel, which during the 1990s became a well-developed cluster with all the necessary complementary services.

This book explores a fundamental organizational process—the evolution of a new industry—that is due, to a large extent, to spawning. Spawning is the process by which employees of an incumbent firm found their own new venture, usually in the same industry. The value of this process is not unlike the influence of parents on their progeny because the experience, values, knowledge, and capabilities acquired during employment at an incumbent firm (parent) provide a basis for identifying and exploiting entrepreneurial opportunities. Furthermore, the strategic course—the managerial blueprints for routines and practices—and the culture and technology of newly minted firms in a genealogy

are influenced by the characteristics of the parent company. This is the conceptual foundation of our work, which aims to provide a comprehensive account of the evolutionary process of a modern communication-technology sector.

In this book, we present the evolutionary process of a new industry by taking an innovative historical-genealogical approach based on the mechanism of spawning. This approach enables us to trace the initial conditions under which the founding parent firm is the first in what later becomes a genealogy. We show how those conditions affect the spawning of new ventures and shape the genealogy's evolutionary trajectory and structure. In this way, we offer a new lens for looking at intergenerational dynamics and shed further light on the evolutionary dynamics of the emergence of industries. Furthermore, by focusing on genealogical evolution, we can empirically trace the specific features associated with the founding processes of new ventures in terms of their birth origin and along multiple generations. These features, in turn, influence the potency, or the reproductive capacity, of the entire genealogy.

In his new book, *The Founder's Dilemmas: Anticipating and Avoiding the Pitfalls That Can Sink a Startup*, Noam Wasserman notes, "Stinchcombe (1965) argued that the liability of newness was due to three internal factors—the need for the team to develop working relationships, to find their newer roles, and to split financial rewards among themselves—and one external factor, the lack of relationships with potential suppliers, customers, and other external parties. The last factor has received vast amount of attention, the first three very little" (2012, p. 1). We agree with Wasserman, and the approach we pursue in this book emphasizes the effect of the external environment at the time of founding on several processes internal to a firm and to its genealogy. Thus, we hope to pursue a more comprehensive approach that follows Stinchcombe's framework in a more balanced manner. In this vein, the environment in which the Israeli high-tech industry has evolved features unique historical conditions marked by the government's active intervention in directing and regulating the industrial industry growth of the young nation. Objectives such as nation building, defense considerations, employment creation, and immigration absorption were the state's priorities, often irrespective of economic considerations. For example, from the state's early days, its defense policy emphasized resource mobilization and self-sufficiency. Consequently, the government established R&D facilities that focused on innovation in applied technology and that supported applied research in higher-education institutions (e.g., Drori and Landau 2011).

### Theoretical Roots

The theoretical roots of our genealogical approach are grounded in institutional and ecological theories. These theories point, respectively, to the role of institutions in providing regulative, cognitive, and normative support to newly founded firms, and to the environmental determinants of organizational diversity, which influences their survival. Specifically, environmental conditions at the time of founding, as well as an organization's age, newness, and size, affect its structure and operations following the evolutionary processes of variation, selection, and retention. However, these theories do not explain how particular events generate a selection process that results in heterogeneous evolution patterns; nor do they illuminate the process by which organizational inheritance fosters a firm's persistence and transformation over time.

Other theories explore the origins of capabilities and core features of organizations. Imprinting approaches assume that an organization's core features imprint on its progenies and thus influence the entire evolution of an industry. Consequently, founders of new firms may introduce innovations that are based on knowledge gained while working at a parent firm. Such factors influence the number and size of firms in a genealogy. A new firm's strategies are influenced by pre-entry experience inherited from the parent company, such as human resource and employment blueprints and technological and market knowledge. Imprinting theories underscore exogenous forces and initial conditions, but they underplay the role of interactions among industry players and so offer limited insight into the forces that drive the emergence of industries and the competitive positions of firms. In contrast, our approach embodies a more comprehensive perspective that increases our understanding of the mechanisms and processes behind an industry's evolution.

Another approach to studying the evolution of industries emphasizes co-evolution processes. It identifies technological advancement as a driver of industry evolution and focuses on the interplay among innovation, industrial structure, and economic growth. Unlike aforementioned approaches, co-evolution takes into account the role of national institutions, among various other stakeholders, and emphasizes the interactions and causal linkages among organizations. Technological progress and industry evolution are considered both outcomes and drivers of change. However, aside from the general notion that evolving entities are interdependent, the co-evolution perspective prescribes no systematic patterns of evolution and pays no particular attention to the development stages of emerging industries.

Where new industries come from and what determines the early success of innovators in them are questions that have not been fully addressed in extant research. Some studies emphasize exogenous factors that drive corporate change; others consider endogenous processes and interdependencies across organizations. However, most ignore the founding stage of industry evolution and its influence on the prospects for industrial growth. These issues are critical in light of the largely risky investments that such industries make.

The significance of this book stems from pursuing a genealogical approach, which (1) advances research on industry evolution from its early founding to maturity; (2) uncovers the principles of genealogy construction and its potential for explaining the emergence and growth of a new industry; (3) analyzes the history of the Israeli ITC sector as an example of industrial development within an emerging economy; and (4) identifies key success factors in the telecommunications industry that can help policy makers and innovators in their investment decisions.

### **The Research Setting**

We present the case of the Israeli high-tech industry and, in particular, its ITC sector, which has experienced tremendous progress in recent years. Renowned worldwide for its innovativeness and technological breakthroughs, Israel's ITC sector is considered a global success story and the growth engine of Israel's entire high-tech industry. In fact, the evolution of this sector is posited as an alternative model (Senor and Singer 2009) to Silicon Valley and is imitated by many advanced and emerging economies. Furthermore, Israel is a natural laboratory in the sense that it is a pioneer and innovator of modern communication technologies. Because it is a small country, we can effectively study most of the firms involved in the emergence of its telecommunications industry and combine field research with survey data as a means to establish a profound understanding of the industry from its embryonic through its mature stages.

Fiengenbaum (2007) presents a comprehensive paradigm of the Israeli high-tech industry that emphasizes its multilevel nature from a strategic management perspective. Focusing on the complementary activities at the global, state, individual, organizational, and industry levels, he shows how those factors, together, explain the takeoff phenomenon in the 1990s. Other studies have emphasized different perspectives, such as the role of venture capital (Avnimelech and Teubal 2003a, 2003b, 2004, 2006); the configuration and advantage of the Israeli high-tech cluster (de Fontenay and Carmel 2001); the role of national research and development policies and the "industrial-military complex"

(including the defense industry at large) (Breznitz 2005a, 2006, 2007); and the institutional environment (Zilber 2006, 2007, 2011). Although these studies contribute significantly to our understanding of Israel's ITC evolution, their limitation is that they have focused on industry-related processes.

Our work explores the evolution of the Israeli high-tech industry over the last sixty years, focusing on two interrelated units of analysis: the industry and the firm. Again, our approach is genealogical, based on the theoretical foundation of parent-progeny relations, which have attracted recent attention in management research (Phillips 2002, 2005). By studying the full genealogical evolution of an entire industrial sector, we can trace the roots of founding and growth and predict and direct future sustainable growth at both the industry and the firm level. We focus on the founders of nine genealogies who have been involved both directly and indirectly in the creation of over nine hundred high-tech companies. Thus, in addition to contributing to theory, our findings can aid public and business policy makers in competing more effectively in global high-tech markets.

### **The Book's Structure**

Chapter 2 presents the theories underlying the main approaches of the existing literature on the emergence of Israel's high-tech industry. These theories point to the role of environmental determinants of organizational diversity related to entry and survival of organizations, as well as to the ways in which institutions provide regulative and normative support. Specifically, environmental circumstances at the time of founding affect organizational structures and operations through the evolutionary processes of variation, selection, and retention. However, such theories fall short of explaining how particular events generate a selection process that results in heterogeneous evolution patterns. Consequently, we still know too little about the organizational inheritance that fosters firms' persistence and transformation over time.

As mentioned earlier, the co-evolution approach considers the role of national institutions (among various other stakeholders), emphasizing interactions and causal linkages among firms. However, it offers no systematic patterns of evolution and pays no particular attention to the development stages of emerging industries.

Chapter 2 also provides a detailed description of our genealogical approach, unfolding its origin and its intellectual and theoretical foundations and principles. The basic assumptions of our approach are as follows. First, new ventures' evolutionary paths are influenced both by their conditions at founding and



by the imprinting effects of the organizational characteristics that shaped the founding processes. Second, those characteristics are transmitted through generations. Such a claim implies that “offspring” inherit certain “genetic” characteristics of “parents.” We conjecture that the structure and characteristics of a genealogy and, ultimately, its size are affected by its particular line of heredity and affinity. The relations among founding firms and their progenies along different generations shape genealogical growth or potency, as measured by the number of newly spawned firms. We seek to understand the distinct influence of the founding parents on the evolutionary trajectory of the entire genealogy and, eventually, on its respective industrial sector. In so doing, we expand on the concept of heritage by analyzing the characteristics that are transmitted through intergenerational relations.

The chapter concludes by contending that tracing genealogies from founding parents to their next generations provides a new understanding of how industries grow.

Chapter 3 describes in detail the historical evolution of the founding parent organizations of the nine genealogies we examine and analyzes their particular characteristics. The chapter differentiates between the founding parents of two groups of genealogies—“old” and “new”—that were founded during two different historical periods. The old genealogies were created during a period we term the *cooperative economy*; the new genealogies, during the period we call the *competitive economy*. The former describes the institutional environment and policies during Israel’s formative years—that is, from approximately 1948, the year of the country’s independence, to 1977, the year of its political turnaround. This period is marked by centralized government intervention and substantial ownership of major economic enterprises by the country’s labor federation. The latter period, the competitive economy, describes the institutional economy from 1977 through 2010, a time characterized by the country’s transformation into a liberal, market-oriented economy and its integration into global markets. We describe the basic traits of each genealogy in terms of its historical development, its organizational characteristics, and its imprinting potential. We show how and why the new genealogies that evolved during the great communication revolution of the 1980s were more entrepreneurial and so have been more dominant in the sector’s evolution.

Chapter 4 describes the structure and evolution of the nine genealogies we study, differentiating between those founded during the cooperative period and those during the competitive period. Through an analysis of founding models and processes, we demonstrate how the structure and characteristics of

the environment at the time of founding have an impact on the entrepreneurial tendencies of the founding parents. We also show that these tendencies are transmitted along generational lines of the particular genealogy. These characteristics, which pass from one generation to the next, preserve the propensity of the founding parents to spawn new ventures and influence the size and nature of the entire industrial sector.

Chapter 5 presents an analysis of the processes that led to differences in the genealogical evolution of Israel's high-tech industry. It also examines how these processes affected the growth of the ITC sector and its ability to become a technological and market leader. The chapter continues by considering the implications of our theoretical approach and the ways in which it explains the industry's growth.

Chapter 6 pulls together what this book has studied and accomplished—its major findings and how they relate to genealogy theory. We conclude, first, by considering the implications of our findings and, second, by speculating as to why Israeli high-tech has been such a successful endeavor.

The Appendix presents the historical background of the Israeli high-tech industry in general and the ITC sector in particular. It deals with the historical, social, and political processes that led to the emergence of high technology in Israel.

### **Summary**

This book is about the mechanisms that brought about the evolution of Israel's high-tech industry. Our genealogical approach rests on the idea that the entrepreneurial tendencies of a genealogy are the source of its diverse evolutionary paths. Yet, among the genealogies we study, there is significant diversity in the mechanisms that led to spawning. Such mechanisms influence a genealogy's ability to spawn new firms. Different rates of spawning for each genealogy determine its evolutionary trajectories and thus its influence and dominance. We show how the historical path and specific characteristics of each genealogy can help predict the evolutionary trajectory of the sector as a whole. Eventually, different genealogical characteristics stem from the *genetic variations* existing within and between offspring, families, or branches of lineages. These are transmitted either directly, from parents to progeny in a successive line, or indirectly, from the first to later generations. Ultimately, our analysis of the growth process of Israeli high-tech may provide a conceptual framework for explaining the evolution of an industrial sector, regardless of its type and/or national origin.