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Anchor entrepreneurship and industry catalysis: The rise of the Italian Biomedical Valley

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ABSTRACT

Accounting for the rise of the medical device industry in the Emilia-Romagna town of Mirandola from a once depressed agricultural area in 1962 to a world-manufacturing center for dialysis equipment and disposable plastic medical devices, requires in large measure mapping the methods of the local entrepreneur who spearheaded its development. Reworking Agrawal and Cockburn's anchor-tenant hypothesis highlighting the role of large organizations in fostering agglomerations, this paper privileges the Schumpeterian entrepreneur as the dynamic force driving new industrial formations. This anchor-entrepreneur with no prior experience in manufacturing medical devices and without any public financing or large private backers founded six firms. Each of these would be sold off fairly quickly to a different large multinational corporation. Placing the anchor-entrepreneur at the center stage advances understanding of early industry evolution, spelling out how first-mover pioneers shape the environment to establish the first markets needed to attract new resources and capabilities. Underpinning our argument are 61 fine-grain interviews with key medical device industry informants in addition to extensive secondary sources and historical records. We draw on this material to induce a stylized model of anchor-entrepreneurship and industry catalysis that rests on three generative processes: bricolage, second-hand imprinting and beaconing.

1. Introduction

How does one resurrect an economically depressed town? One blessed with good farmland and abundant water, but without the right combination of competitive manufacturing inputs and resources. And burdened by skeletal public transport and bad roads, made worse by late autumn's and winter's dense fogs that blanket the land, isolating it from major population, scientific and research centers. With only a modest sixteenth-century palace of the celebrated Renaissance polymath Giovanni Pico, not even tourists had good reasons to stop there. Counting just five small factories – a sugar refinery, a maker of school-bus frames, an industrial-biscuit bakery, a manufacturer of curtains and a firm producing plows - back in the early 1960s Mirandola, a provincial Modena town marking the northeastern confines of Emilia Romagna southeast of the Po River, did not appear to have a bright economic future. But less than a decade later it had earned a spot as one of the world's leading manufacturing centers for extracorporeal-blood and oxygen-medical devices and for kidney-dialysis machines. Today approximately one-fifth of Italy's medical-device firms call it home, accounting for about thirty percent of the nation's industry revenues.

We try to solve this puzzle of industry emergence in a region where the requisite building blocks defined by neoclassical economics were nowhere to be found. Figuring large in this puzzle of Mirandola's industrial genesis is Mario Veronesi, a Schumpeterian entrepreneur, who in 1962 from his parents' home garage started assembling simple medical kits made of nontoxic disposal plastic tubing for blood tests and transfusions. By establishing primal markets in labor, material inputs and services, he laid the foundations for a burgeoning industry that would form the embryo of a dynamic medical-devices manufacturing center. As much as Veronesi unquestionably transformed Mirandola from a rural backwater into an internationally recognized medical-device cluster, ours is not an account praising muscular, purposive, instrumental behavior (Hardy and Maguire, 2008). Rather as we will recount many of Veronesi's successes came accidentally, a result of serendipity, being present at the dawn of an emerging medical field that married knowledge about renal and cardiac treatment to improved plastics. A time when large multinationals not only offered relatively rudimentary technology, but were still largely absent from the medical-device marketplace. It was a historical moment allowing bold innovators like Veronesi to seize the initiative. So random factors like

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chance and entrepreneurial optimism, which Storey (2011) says explains why some new ventures succeed while most don't, helped Veronesi progress. But the blessings of randomness and serendipity that occasionally give birth to new industries at unexpected times and places - what David (1985: 332) and Krugman (1991: 156) have dismissed as "historical accidents"- must not dissuade social scientists from exploring how these events inform a process account of industry emergence. And in our example this emergence began with an ancestral founder whose primordial economic actions set off cascading effects within a defined geographic space, awakening the animal spirits of both neophyte and seasoned economic actors by signaling unimagined possibilities of wealth creation and development.

Central to our explanation is the *anchor-entrepreneur*. In our reformulated use the anchor-entrepreneur (hereinafter anchor) performs a generative role across multiple phases and processes to ignite economic change. Phase 1 is genesis; the moment when the anchor conceives and formulates an idea calling for economic action. But lacking the requisite inputs and resources to realize it, he engages in *bricolage*; what the anthropologist Claude Levi-Strauss (1967) identified as "making do with what's on hand". Challenged to make a new product unsupported by any specialized markets (Aldrich, 2010) or even references to existing models compelled Veronesi to take chances, experiment and learn from errors (Sarasvathy and Dew, 2013). Starting with assembling plastic, nontoxic parts and tubes to make customized, drug-infusion kits ordered by hospitals, his little start-up took on making more sophisticated devices for blood tests, transfusions, and drip lines. Gaining both new skills and customers for his expanding range of customized, plastic-medical devices, Veronesi found himself thrust into experimenting with manufacturing kidney dialyzers, comprising not only plastic tubing but also electronic, electrical and mechanical components. Veronesi's ingenuity resided not in inventiveness - in the early stages others had developed the materials, tools and techniques used – but in harnessing a diverse network of physicians, hands-on technicians and scientists to help with bricolage: re-engineering, reworking and altering the work products of others to the challenges at hand (Stark, 1996; Baker and Nelson, 2005; Baker, 2007).

Phase 2 of our story is expansion; the transition from individual-level learning to organizational-level outcomes. Here simple entrepreneurial heuristics (Manimala, 1992) – i.e. "articulated and often informal rules-of-thumb" - pioneered by the anchor are assimilated by early team members, instigating organizational reproduction (Phillips, 2002; Klepper, 2007). Central to this phase is *second-hand imprinting*; the process of "the social transmission of imprints" (Tilsick, 2014, p. 641) by which actors assimilate elements of an anchor's imprint. Inherent in second-hand imprinting are the genealogical ramifications triggered by the anchor via team members-turned-founders following early exposure to the anchor's entrepreneurial actions and decisions (Stuart and Ding, 2006; Ferriani et al., 2012; Feldman et al., 2019). Second-hand imprinting sustains imprints across subsequent generations of firms.

Phase 3 is attraction, and here *beaconing* is the underlying generative process that occurs once anchors reap exceptional and salient rewards observed by other entrepreneurs and resource-holders (Bermiss et al., 2017). Beaconing also stimulates emulation effects, especially in a clearly demarcated geographical region where not only the quality and saliency of information exchange is frequently greatest, but where network effects increase the likelihood that others will emulate the anchor (Bermiss et al., 2017; Markusen, 2003). To sum up, a single anchor may exercise multiplier effects on regional development and business formation and thereby thrust the industry into the limelight.

We add empirical flesh to these processes with strategic research material (Merton, 1987) that parses the medical-device industry's origins in Mirandola. Starting with a conceptual agenda, we rely on evidence that sharpens, illustrates and grounds our arguments. Then we weave these arguments together to show how entrepreneurial action catalyzes industry emergence. In placing Mario Veronesi at the forefront of this model, we take up Aldrich and Fiol's (1994, p. 666) challenge: "The social construction of organizational reality involved in building a new industry requires meaning making on a grand scale, and we suspect that those entrepreneurs who do it well are obsessed with the process. As such, they make fascinating subjects of study". By spotlighting a pioneering entrepreneur's catalytic role in spawning a new industry, we hope to both enrich and stimulate current debates on the early evolution of industries (Aldrich, 2010; Alvarez et al., 2015; Agarwal et al., 2017).

2. Conceptual background

Mapping and pinpointing the processes underlying novelty emergence – the germination of ideas, forms, fields, and industries - occupies a central place within organizational theory (Padgett and Powell, 2012). But paradoxically scholars, no matter their theoretical perspective, also agree how so much of that space still remains unexplored[1]. Reviewing the existing literature reveals different theoretical responses to the question of industrial emergence. Industry-lifecycle models advance a stylized evolutionary pattern that demonstrates validity across a variety of industries. The pattern contains various stages: an early quasi-monopoly period of a handful of firms; a growth stage marked by accelerated firm entry; a shakeout stage of firms suddenly exiting; and finally a mature stage (Gort, 1982). But with notably rare exceptions the lifecycle model essentially recounts histories of well-established firms, while indifferent to new firms struggling with innovative products that are saddled unavoidably with the costs of trial and error (Moeen and Agarwal, 2017). All this leaves our knowledge about economic action at the dawn of industry formation diminished (Agarwal et al., 2017). Organizational ecology, on the other hand, with its traditional, expansive temporal scale does offer a compelling account of collective patterns of activity that determine the vitality of existing firm populations (Hannan and Freeman, 1977, 1986). But by restricting data analysis to the population level, it buries crucial micro-level economic action such as improvisation, bricolage, and recombination, precisely the kinds of economic action that seed embryonic organizations (e.g., Stark 1996; Johnson 2007; Powell and Sandholtz 2012).

Social movement theory compensates for a few of population ecology's blind spots by photographing the actions of under-resourced challengers or well-heeled incumbents (Hiatt et al., 2009; Pacheco et al., 2014). But as much as it elucidates emergent mechanisms in established fields where dissatisfied activists challenge the status quo, it abandons at the wayside emerging ones, where shared interests, power relations, and coalitions have yet to gel (David et al., 2013). Institutional analysis has been reinforced by actor-centric explanations that acknowledge the generative power of pioneering entrepreneurs and highlight micro-level processes of organization-

[1] Take for instance Aldrich: "The period during which a new industry emerges deserves more theoretical attention" (1999, pp. 256–258). Or Powell, Packalen & Whittington (2012: 434) who analogize the social science treatment of new institutional forms to a bizarre play that begins with the second act, confronting the audience with a mindboggling challenge to make sense of a narrative and a plot neither explained nor developed: "Very little research asks how a play comes to be performed." Greenwood et al (2008, p. 26) in a similar vein note that "institutional studies have not been overly concerned with how institutions arise." In a recent study of Israel's information, communication and technology (ICT) industries, Ellis et al. (Ellis, Aharonson, Drori, and Shapira, 2017, p. 519) lament how "studies of industry evolution tend to consider industries as given, and dismiss the dynamics leading to the emergence of new industries." Although Stinchcombe (1968) rightly recognized how organizations bearing the congealed imprint of their history recall the timeless words of King Solomon in Ecclesiastics that "there is nothing new under the sun," from time to time novel exceptions merit attention.

building, which escaped early neoinstitutional work. Yet institutional entrepreneurship suffers from its own blind spots. By highlighting intentionality such explanations tend to rely on teleological categories such as power or superior skills to explain outcomes, overlooking how most actors lack either the capacity to change or create fields (Garud et al., 2007; Hardy and Maguire, 2008). Commenting on this failure, Clemens and Cook (1999: 460) warned, "to appreciate human agency, we should beware of assuming every actor a Cosimo de Medici." Despite institutional entrepreneurship's worthy attention to agency and institutional change, "it has had limited focus on how entrepreneurs pursuing wealth creating opportunities contribute to the origin and emergence of new institutions" (Alvarez et al., 2015, p. 97). In short, the institutional approach may be better for observing change in existing entities than for capturing those fleeting moments at the break of day when an industry's first stirrings become visibile (Aldrich, 2010; Forbes and Kirsch, 2011).

To sum up, each of the above macro-, meso-, and micro-levels approaches of social analysis contribute complementary and compelling insights into the birth of new industries. Nevertheless, the methodological and theoretical limitations of each approach severely circumscribes its contribution to knowlege (Garud et al., 2007; Powell and Johnson, 2017). Most conspicuously none of these perspectives registers those moments when the economic actions of a pioneer unintentionally spark a new industry. Something that may occur without any of the requisite preconditions: no launch-ready product; no collective patterns of vigorous activity; no distributed mobilization; and no farsighted-purposive vision. In the following sections addressing Mirandola's puzzle, we offer an account of industry emergence where pioneering entrepreneurs trigger ambiguous generative processes whose societal ramifications are largely unintended, even when they are products of individual initiative. In detailing these processes, we develop a stylized, conceptual model of entrepreneurial action catalyzing large-scale transformation through industry emergence.

3. Research design and method

To explore the emerging field of how agency spawns nascent economic organizations we chose a longitudinal case study (Van de Ven, 2007; Yin, 2009). Thanks to the medical-device industry's relatively small size and short history in Mirandola, our fine-grain account included most of the key firms and actors. Further aiding our inquiry, most of the original founders including Mario Veronesi were alive during data collection; some still were even involved in the industry. The city's relative geographic isolation reinforced by its cultural particularism, the strong local identity of its population and an enterprise structure dominated by a dense medical-device network all contributed to making Mirandola a good "strategic research site" (Merton, 1987) by "bounding our phenomenon of interest in a tractable manner" (Chiles et al., 2004: 503). The bounded nature of our subject matter with few confounding factors helped restrict extraneous variances, yielding a high "signal to noise ratio". Next we illustrate the research context, the data and the analytic strategy.

3.1. Context

Mirandola certainly was no Robinson Crusoe island: It had power, water, sewers, and healthcare; several small workshops run by skilled machinists; and state-enforced property rights. After the new autostrada opened in 1962, Milan could be reached in about three-to-four hours, and a few years later the newly opened A22 high-speed, toll road finally linked Mirandola to central Europe, even if modern access roads have yet to be constructed. In any case, persistently poor road and rail infrastructure – still little improved by 2020 – along with Italy's high petrol and road charges have long put the regional capital of Bologna - a fifty-to-eighty-minutes' commute – beyond the labor-market catchment area. Moreover, particularistic Italian family and cultural factors to this day constrain geographic-labor mobility. Modena, the provincial capital - forty-five minutes away - has long been home to engineering and medical schools, but their faculty never collaborated with Mirandola's medical-device industry, feeling doing so brought no professional rewards. Indeed Dr. Spolvieri the lone exception who helped Veronesi perfect the oxygenator, was a visiting professor from Rome. Medical schools and hospitals did help Veronesi develop the kidney dialyzer, but they were not located in Emilia-Romagna.

In 1962 when Mario Veronesi opened his start-up, the country's relatively low-labor costs did provide Mirandola a competitive advantage compared to most other European countries. But by the early 1970s Italian-union militancy and above-average inflation had eroded any cost advantages. Nevertheless, twenty-five years after Veronesi's first start-up, Mirandola had become home to no less than five multinationals, placing it third in world manufacturing for hemodialysis products and other disposable, plastic-medical devices.[2] An additional eighty-to-ninety-small - to medium-sized firms furnishing either auxiliary and subcontracting services for the multinationals or else making niche products completes the picture. Taken together these firms employ approximately 5000 people and generate 1.5 billion Euro in revenues. How then to explain Mirandola's puzzling success?

3.2. Data

Primary data. Initially assisted by the local industrial association and the personal connections of one of the authors, who has tracked this industry for almost 30 years (Lorenzoni, 1988; Lazerson and Lorenzoni, 1999, 2016), we pursued a snowball approach, interviewing new informants until we started confirming our existing information. We ended up with thirty-four key informants from multiple groups: local firm-founders and entrepreneurs, multinational managers, representatives of various local trade associations, trade journals, publicly-financed groups and even the curator of Mirandola's Biomedical Museum, an engineer and former entrepreneur. Key informants were interviewed multiple times resulting in 61 semi-structured interviews lasting from forty minutes to several hours each.[3] All face-to-face interviews were tape-recorded and transcribed; if necessary follow up telephone calls were made to clarify ambiguities or obtain updates.[4]

The interview questions focused on the participant's actual involvement in and knowledge of the medical-device industry and especially his or her relationship with Mario Veronesi. Because many of our informants were both industry pioneers and Veronesi's collaborators, we concentrated on stories about the origins, processes and outcomes of their entrepreneurial efforts. Interviews with the managing directors of the multinational plants were asked not only why their firms settled in Mirandola, but why they remained, wanting comparisons with any of their worldwide-production sites. We also explored relationships between multinationals and locally owned firms. To correct for any unconscious interviewer bias, facilitate collective learning, and add further depth, in the beginning two of the authors interviewed approximately one-fifth of the respondents. After completing a tentative semi-structured interview protocol but open to exploring any new, promising channels of inquiry, one author completed most of the

[2] Counting buyouts, mergers and spinoffs the multinationals that have invested in Mirandola at some point is a Who's Who of the giants of the medical device industry: Sandoz, Rhône-Poulenc, Hospal-Dasco, Gambro, Pfizer, Baxter-Travenol, Tyco-Mallinckrodt, Covidien, Medtronic, Fresenius, B.Braun, Snia-Viscosa, Sorin.

[3] All our interviewees gave their informed consent to participate in the study and authorized full disclosure of their names.

[4] In the course of data collection, we made multiple visits to Mirandola extending over a period of ten years, affording direct exposure to the local milieu (culture, institutions, foundations, etc.). We attended several congresses and local regional development conferences. We visited Mirandola's biomedical museum as well as private and public industry associations and consortia.

Table 1
Secondary data sources.

Data source	*Details*
Published articles, comments, commentaries on Mirandola's biomedical industry	Articles and commentaries published in the business/trade press and online blogs accessed from databases such as ABI/INFORM Global, Factiva, ProQuest and through extensive Google searches. Scholarly articles on Mirandola's biomedical industry downloaded through keyword searches of ProQuest, JSTOR and Google Scholar
Websites of companies	Company histories
Industry association websites	News releases and information published by industry associations (e.g. Consobiomed, Distretto Biomedicale Mirandolese)
Industry reports	Sectoral studies promoted by chamber of commerce and industry associations
Books	Biographies of key players and contributions in edited volumes searched through Google books
Audio video files	Transcripts of interviews of key founders available online (Mario Veronesi and some of his early collaborators)

remaining interviews. Appendix D lists the interview respondents and their position when interviewed, prior relevant roles and the number of interviews.

Secondary data. In addition to primary data, we collected archival data through keyword searchers of archival sources, including newspapers, press kits, websites, reports, university theses. Other archival sources include scholarly articles and cases on the industry, as well as Chamber of Commerce publications, industry reports from Mirandola's medical-device associations and biographies. Finally, via audio-video files we accessed six interviews of Mirandola's original founders conducted by others between 2010 and 2015. Including the sixty-one interviews we conducted, we had access to 67 interviews. Triangulating multiple-data sources helped uncover key events, their sequencing, their interactions and cumulative effects, while mitigating the risks of retrospectively imposing meaning on events because of our knowledge of outcomes (Golden, 1992). Taking the interviews, the documents, and the secondary data together resulted in a nuanced and textured understanding of the dynamics that shaped the industry's early development. As noted by Lippmann and Aldrich (2016, p. 662): "Historical analyses of such pioneering entrepreneurs and their firms can help us understand the evolutionary forces behind transformational social and economic change." In presenting our findings, we cite archival sources parenthetically, using numbers that correspond to a detailed list in Appendix E. Table 1 summarizes our archival sources.

3.3. Data analysis

Our data produced a robust chronology of the genesis and early development of Mirandola's medical-device industry from 1962, the date of the first founding, until the late nineties, when we terminated our historical account. Fig. 1 provides a chronology of both the major events during the first thirty years of Mirandola's medical-device industry and of the annual opening of new medical-device firms. Our analytical approach employs a temporal, bracketing strategy (Langley, 1999) that decomposes into three successive and discrete phases the chronological data of the emergence and early evolution of the industry: genesis, expansion and attraction. These phases do not imply any predictable sequential process, but rather offer an illustrative heuristic that highlights and sharpens distinctive patterns (Langley 1999, p. 703). The boundaries separating these three periods can be loosely defined by significant changes in the evolutionary trajectory of the industry. Specifically, these phases allow the constitution of comparative units of analysis for the exploration of theoretical ideas (Denis et al., 1996). By analyzing the evidence, revising the emerging concepts, and iteratively returning to the data, we refined key constructs and organized them into a stylized model of anchor-based industry catalysis.

4. Findings

The three stylized phases of genesis, expansion and attraction, deriving from the emergence and development of Mirandola's medical-device industry, present a particular evolutionary pattern. For each phase, the generative processes and developments have been situated within a larger chronology to better grasp the underlying dynamics (Van de Ven and Poole, 1990). Illustrative quotes, decisions and practices are contained throughout the paper and in a greater detail in Appendix A.

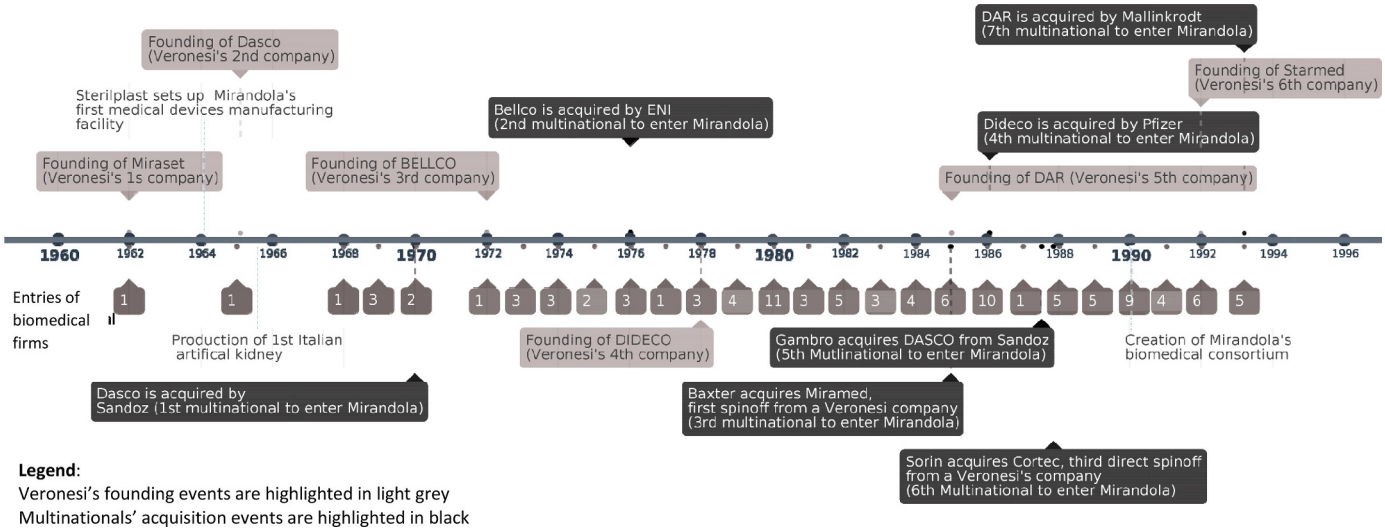

Fig. 1. Chronological display: key events in the first 30 years of Mirandola's biomedical industry development.

4.1. Phase 1: Genesis

In the late 1950s the American multinational Pfizer hired Mario Veronesi on commission to provide information about its pharmaceuticals to hospitals in the Veneto and Emilia Romagna regions, while he was operating one of Mirandola's two licensed pharmacies. This experience exposed him to the daily problems of hospital staff, including not only costly medical devices but more importantly the market's failure to provide them with simple and practical medical devices for their work. For example, the common practice then in Italy and indeed nearly everywhere else of reusing rubber tubing and other medical devices required that they be sterilized. But this procedure posed a constant risk of infection not to mention the time and cost involved. Single-use disposable drip lines and blood-transfusion kits to avoid contamination were mostly unavailable if not actually unheard of. Veronesi explained how he happened upon the idea of making disposable, plastic, intravenous-gravity-drip lines:

> "It all started by pure chance. A boyhood friend of mine, Agide Campana, who was a chemist and who often came to visit the pharmacy, was collecting plastic tubes for intravenous drip systems (iv). At that time the tubes were sterilized and then reused multiple times, often with harmful effects. I had experienced first-hand their limits and use in hospitals during my years as a pharmaceutical's information officer in 1958. I figured the introduction of disposable plastic tubes could dramatically reduce those problems. My three years (1955–1958) as a salesman in many hospitals taught me how the hospital-supply system works, but more crucially how doctors think. These experiences profoundly affected my professional path, and it was this line of thinking that eventually brought me to the decision to found Miraset (Veronesi's first firm) in 1962″ (Veronesi, "La Plastica della Vita", p. 5)

Starting out with two partners - both boyhood friends from Mirandola - one was a certified public accountant and the other produced saline solutions in Florence - Veronesi quickly moved from assembling a few kinds of plastic-medical devices for hospitals using purchased components to manufacturing many kinds. Expanding his competencies and his labor force, his firm grew from three to twenty-three workers in just eight months, while it was still based in his parents' home. Working from this rent-free location and near to family, friends and acquaintances, many of whom helped advance his business goals, Veronesi never invested in studies to find the most efficient and competitive manufacturing site. Even had he done so, a cost-benefit analysis could never have predicted the importance of Mirandola to both Veronesi and to his first hires, most of whom would continue working with him for decades. For them Mirandola was not just their birthplace and home, but an essential element of a shared culture, community and history. Putnam (1993) and others have detailed the strong cultural, linguistic (the local Mirandola dialect is still widely spoken) and familial attachments that have characterized daily provincial life in Italy's central and north-central regions at least up until the beginning of the twenty-first century (Pitkin, 1988).

Lack of skilled jobs in Mirandola had forced many vocational school and university graduates to flee Mirandola to Milan, Turin and even further destinations, despite their desire to stay put. Veronesi counter-intuitively turned Mirandola's economic isolation to his advantage, enticing young scientific and technical people forced to seek work and learn skills in northern Italy's industrial cities or even abroad back to Mirandola. Thus from scratch he formed the town's first skilled-labor market. In the beginning nearly all of his recruits were suggested by friends and relatives or their acquaintances, reflecting the multiple nodes of Veronesi's rich and dense social network (Greenwood, 2008). They saw Veronesi performing a social role of strengthening the community by bringing their children not only back home, but giving them a good job in Mirandola's first industrial initiative. So, with no industrial workforce to speak of and facing severe transport, housing, cultural and geographical constraints that had narrowed the effective labor catchment, Veronesi redefined the parameters of the local-labor market then prevalently defined by agriculture and a thriving knitwear industry (Lazerson, 1990). Paying above the prevailing area wage, he also turned to unskilled female labor, initially employed mostly to cut, solder and assemble plastic tubing.

Understandably, when Veronesi's inexperienced team initially set up shop to make disposable, plastic-medical kits, and even more so when making kidney-dialysis machines it was hit and miss. But at the same time, familiarity with Mirandola's agriculture reaped unexpected dividends for bricoleurs. Informed that the medical kits would need to be sterilized, they soon realized that ethylene-oxide gas, cheap and widely used in the area's ubiquitous pear orchards to sterilize fruit would do the trick. But while pears could be sprayed, medical instruments needed to be sterilized inside a pressurized, sealed container called an autoclave, which they did not have. But then someone recalled that to process mortadella, a variety of pork sausage and a local culinary delicacy, required an autoclave. They then found a local butcher shop to loan them one, and after converting it their problem was solved.[5]

Sensitive to his organization's liabilities, Veronesi redeployed his recruits possessing generic skills to job positions requiring specific abilities. And in our interviews those who had some experience in chemistry, hydrodynamics, electronics and engineering design conceded that initially they knew nothing about hemodialysis or even medical plastics. So it involved translating and analogizing the skills of his work force to different skills relevant to manufacturing medical devices. Table B1 in Appendix B illustrates the ancestral team that formed around Veronesi.

For instance, the chemist Leonardo Bigi, one of the earliest recruits with a university degree, first worked in a northern petrochemical plant where he learnt about fluids; but paint fluids coursing through hydraulic systems, not extracorporeal blood flowing through plastic tubing:

> Veronesi had known me since I was a kid because he was a pharmacist, and I ended up almost every day in his shop to fuel my passion for chemistry, looking for compositions and substances to run my home experiments. So when Veronesi set up Miraset (i.e.Veronesi's first company) he just asked me to create the chemistry-biology lab to ensure quality control of the company's line of products. […] There was a guy whose name was Brembilla. He produced plastics and was a personal friend of Veronesi. So this guy made plastic prototypes, sent them to me and I ran the analyses and controls until we ended up developing medical-grade PVC formulations […] the challenge back then was to get non-toxic plastic material […] Since I was an industrial chemist I was somewhat familiar with the characteristics of plastic materials and I also really liked medicine […] so I had a clear sense of how to formulate medical grade PVC (Leonardo Bigi, personal interview).

Veronesi recast a local electrician who had been installing wires in

[5] It should be noted that Veronesi's talent in reworking tools, inventions, and technologies developed by others benefited significantly from some critical advances in plastic technology that occurred in the two decades before his entrepreneurial entry. For example, without the discovery of polyvinyl chloride (PVC) prior to World War II and continuous improvements to it afterwards along with declining manufacturing costs during the 1950s, Veronesi's vision would have remained unrealized (Mulder and Knot, 2001). Similarly, the revolution in applying plastics to medical needs for extracorporeal liquids began not in Mirandola but rather in Rochester, Minnesota at the Mayo Clinic in 1950 when a doctor there managed to fit a plastic catheter to a needle permitting venipuncture that allowed the blood to flow smoothly through the tub into an external vessel (Rivera et al., 2005). Similarly, only contemporary advances in extrusion plastics technology and in dies enabled Veronesi to coax craftsmen that had been making molds for plastic toys to reconsider what they had been doing and to start making medical instruments.

private homes and buildings into an electronics technician charged with installing and devising the first dialyzers' electrical systems. Then there was the young telecommunications technician Giancarlo Malavasi, son of a local policeman whose father wanted him back home from Milan where he was making antennas and professional radio transmitters. Veronesi pushed Malavasi to reconfigure his knowledge and apply it to kidney dialysis:

> "Veronesi came to Milan to visit me together with his business partner, Carlo Gasparini. He knew me through my father who was Mirandola's traffic policeman! So he learned that I had earned a technical diploma and was working for this company. Of course I had no experience whatsoever in medical devices however […] I had electronics know-how which could be used, especially because I had been studying thermionic valves […] that is why my very first job at Miraset-Sterilplast was to develop a conductor to measure the osmolality of a solution for dialysis, that is the liquid to be used for extracting impurities from blood through an osmotic principle (Giancarlo Malavasi, personal interview).

The scientific laboratory process that marked the firm's early days invariably meant long and uncertain hours. One interviewee captured the atmosphere of those frenetic days when asked about his schedule. Laughingly he replied, "there wasn't one". Fortunately, like university doctoral students these mostly young technicians without their own families still lived with their parents and could work late into the night puzzling out solutions to that day's design and production challenges. This laboratory atmosphere was reinforced when Veronesi brought in the principal of the town's only technical high school who moonlighted training new employees. Veronesi drafted twenty-one-year-old Gianni Bellini, another Mirandola native and family acquaintance, to establish a sales and marketing department. A year earlier Veronesi presciently sent Bellini north to Como to work in a large firm that supplied baby toys and accessories to nearly every Italian drugstore. There Bellini, a university dropout but knowledgeable in French and English, apprenticed at learning how to compile and assemble frugally and rapidly merchandise catalogs; a skill soon applied to publicizing Veronesi's medical devices.

> I was very good in languages, which is the principal reason Veronesi hired me. Our first collaboration started when he had to travel abroad and needed someone who could speak English at that time, when it was not so common […] I was born in Mirandola and most of the people enrolled were from Mirandola (Gianni Bellini, personal interview).

When challenged to climb the really steep learning curve to master manufacturing kidney-dialysis machines, Veronesi and his motley team had the backing of a community of volunteer university scientists and teaching physicians in addition to some paid external consultants. Most of these Veronesi had met directly or indirectly from working for Pfizer in hospitals or from his early reputation manufacturing plastic-medical devices. The chief pharmacist of the University of Padova, who first met Veronesi in connection with an order to make specialized, plastic-tubing devices for dialysis patients, introduced him to Professor Pietro Confortini, an eminent nephrologist who eventually would found Europe's largest hemodialysis center at the University of Verona. Hoping that Veronesi would become an avatar of Italian leadership in medical devices, Confortini lent Veronesi from his clinic a copy of the patent-free Kiil dialysis machine (Kiil, 1960), handmade by doctors in Seattle. This allowed his team to dismantle and copy it over a long weekend (Grabher, 1993). Confortini hoped to extend the brief lives of his chronic renal patients by getting Veronesi to manufacture large numbers of the Kiil dialyzer at reasonable prices.[6] When Veronesi succeeded in doing so in 1965, Confortini's Verona nephrology clinic soon became a showroom for his dialyzers, frequented by doctors and public health administrators from Italy and abroad to observe patients undergoing treatment (Goldoni, 2019). In the absence of official testing of medical devices, Confortini and other nephrologists filled a regulatory vacuum by using their own hospital wards and clinics to test the devices. At the same time, they provided Veronesi with free publicity and sterling references at international medical conferences.

> After Confortini commissioned the first dialysis machine we remained in constant contact with hospital technicians, nephrologists and physicians…they gave us feedbacks and basically ran the clinical trials of the machines we were developing […] they were our field consultants […] Back then only Minneapolis was active in this field; in Europe there was almost nothing. Miraset-Sterilplast pioneered the business in Europe with its biomedical products […] there were no manuals we could follow nor industry experts with whom we could consult. Our approach was 'do it yourself!' (Giancarlo Malavasi, personal interview).

Inevitably, some of the first dialysis machines leaked fluid; on rare occasions some even caused harm. But without a regulatory framework or a powerful, tort-liability, legal community, Veronesi could go about incrementally improving them (Agrawal and Cockburn, 2003). Whatever their defects the machines offered the only near certain alternative to quick death from uremia. Filling a glaring medical void, Veronesi's dialyzers quickly occupied an exalted position among the world's medical-device producers (Agarwal, 2017) (see Appendix F, Figs. F1 and F2, for pictures of the first biochemical lab in Mirandola's history in Sterilplast in 1962 and Italy's first kidney dialyzer, produced by DASCO in 1965)

Much as the region's limited economic opportunities paradoxically aided Veronesi as he proceeded to create a market for skilled labor, similar factors helped cultivate a market for components and supplies. Leery but hungry contractors in the surrounding depressed area risked relatively little joining Veronesi's unproven venture, even if it required constant learning by doing and improvisation and accepting uncertainty about payments, investments, planning and outcomes. Those that signed up were real bricoleurs: collaborators willing to applying their knowledge and skills to whatever was at hand, open to executing conceptually similar but unfamiliar new tasks. As Gianni Bellini told us:

> We purchased the small plastic tubes from a guy named Brambilla while the connectors were manufactured by Comef, not far from here, which at the time produced plastic flowers. After just a few months we became their lead client.

Before Veronesi had approached them, one firm made plastic-injection molds for imitation flowers while the other made plastic window blinds and had once worked as a subcontractor for a foreign medical device firm. Learning to adapt their knowledge to medical-grade plastics took time, money and effort. But Veronesi's cajoling and the promise of a share in a new world of medical technology convinced them. Both of these two firms experienced explosive growth and eventually became major suppliers to Mirandola's medical-device industry.

4.2. Phase 2: Expansion

Scholars of organization and management have come to recognize history's contribution to theory (Lippmann and Aldrich, 2016; Rowlinson et al., 2014). Consistent with this approach, generational concepts inject historical lineage into entrepreneurship studies. In Veronesi's entrepreneurial endeavors, we observed how he had selected the right person for each job, transmitting to each a kind of entrepreneurial blueprint handed down through generations. As an ancestral founder, Veronesi stamped his entrepreneurial know-how and ideas onto the organizational members with whom he interacted,

[6] Fred Kiil was a Norwegian urologist who developed the flat plate dialyzer named after himself.

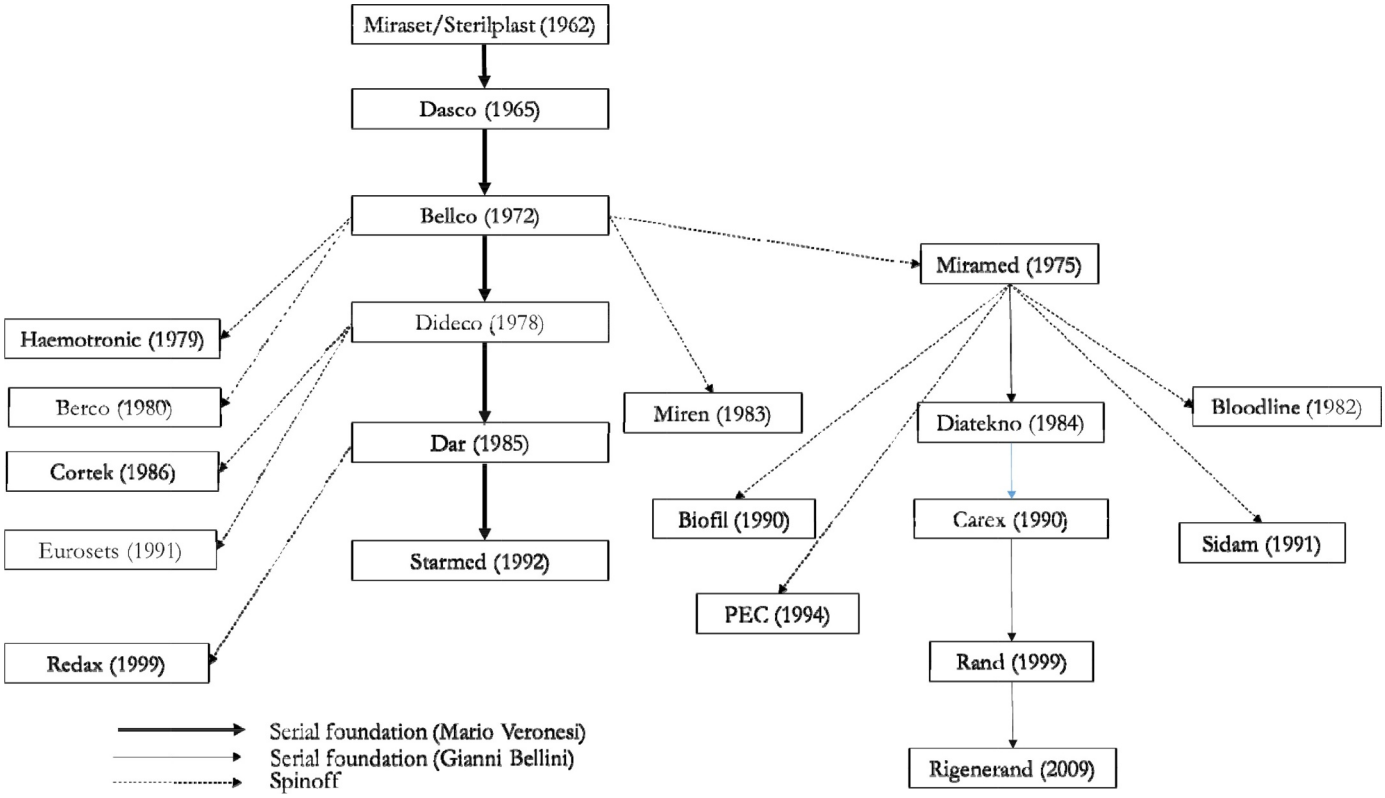

Fig. 2. The generative impact of Mario Veronesi's companies: serial firm founding and spinoffs.

setting off ripple effects across the industry. In particular Veronesi's methods helped inspire his partners and collaborators either to create new independent companies in the image of his companies or to become high-ranking executives of his former enterprises following their acquisition by multinationals. Benefiting from fifty years of history, we can count those recruits who helped shape Mirandola's medical-device cluster: The genealogical branching of Veronesi's early initiatives mapped in Fig. 2 indicates his impact across Mirandola's local system.

This chart maps the companies and spinoffs traceable to Mario Veronesi and his early lieutenants, compressing the information conveyed by genealogical trees (Dietrich and Gibson, 1990; Garnsey and Heffernan, 2005; Mayer and Armstrong, 2011). A genealogy constitutes the degree of association and proximity of relationships over time, characterized by affinity ties among firms along a lineage system (Ellis et al., 2017 Van de Ven and Grazman, 1999). In the stylized figure vertical lineages indicate companies traceable to the same ancestral founder. In particular the central lineage traces the companies founded by Veronesi and his collaborators (Chiles, 2004; Gompers, 2005). The vertical lineage to the right traces the companies founded by Gianni Bellini, Veronesi's first right-hand man who also became a serial entrepreneur (Cattani, 2017; Hardy and Maguire, 2008). Whenever an organization member exited to create a company a new branch in the genealogy emerges. Table B2 in Appendix B summarizes the same information with added details about the career path of each of Veronesi's early collaborators. As shown, many of Veronesi's early employees eventually filled entrepreneurial positions, either forming new companies with Veronesi or striking out on their own.

The economic significance of the branching process stems from the transfer and exchange of knowledge among founders of new firms and former employers. Veronesi devised and enacted various rules of thumb in subsequent companies to capture and exploit opportunities. For instance, core to his entrepreneurial approach was delegating key responsibilities to his lieutenants early on and then prodding them to follow in his footsteps:

> I encouraged my closest collaborators to take responsibility and become partners in the entrepreneurial endeavours I envisioned. Many of my collaborators started as employees and then joined me as co-founders in my subsequent ventures or started their own ventures. I think my approach has always been to try and create not only new companies but perhaps more importantly new prospective entrepreneurs […] Surprisingly, I did this with them and they seem to have replicated the same approach with their employees! (Hannan and Freeman, 1977)

Evidence revealing the perpetuation of this founding pattern reappears in subsequent start-ups. When Gianni Bellini founded Miramed he copied what Veronesi had taught him, immediately giving shares to three former colleagues at Bellco. After establishing Miramed Bellini then founded Diatekno. There too he gave shares to two former Miramed employees. In 1990 Giorgio Mari, the Miramed chemist, joined with three former colleagues and carved out Biofil from Miramed, which would eventually be acquired by the German multinational Fresenius. Franco Poletti, once a Veronesi employee at Dideco (interviewed while VP Global Sales at the UK' multinational LivaNova), underscored this dynamic:

> The Veronesi entrepreneurial model revolved around two key principles that in many circumstances he reaffirmed: the "clinician's cult" and the empowerment of collaborators […] for the fortunes of the companies had to be tied to the fortunes of his lieutenants […] these same mechanisms […] have served me well over the years.

Veronesi repeated such "simple heuristics" (Manimala, 1992; Gigerenzer et al., 1999; Bingham and Eisenhardt, 2011) as a mantra to his employees. Today they have become so much a part of the industry's vernacular that their authorship is no longer even accredited. This linguistic evolution suggests how the founder's legacy transcends generations and recalls the process of second-hand imprinting: "A process whereby an actor takes on aspects of an imprint borne by another actor"

(Marquis and Tilcsik, 2013, p. 226).

During our data collection informants who had worked in companies founded by Veronesi would regularly and spontaneously refer to one or more of his heuristics. They talked about how his rules in everyday practice were assimilated and reenacted, rules of thumb that sustained and guided their own entrepreneurial efforts. Included here are even individuals who had joined a Veronesi company after the founder had already moved on. For instance, from the beginning Veronesi assiduously cultivated strong ties with medical personnel to advance translational processes to identify new medical device opportunities "for a bedside-to-bench-to-bedside program" (Bornstein and Licinio, 2011, p. 1569). This approach has now been widely adopted to lower research and development costs and speed time to market of new medical devices. This quote from a sales director of Dideco-Sorin, who had started working there before Veronesi sold it, captures the lessons learned:

> I soaked up what Veronesi repeated again and again: The doctors tell you what is needed; and as the doctors' tailors we can only grow […] by making custom-made clothes for them.

Stefano Rimondi, a longtime Bellco CEO and today a cofounder of Aferetica, said something similar when asked about finding entrepreneurial opportunities:

> Good ideas are rare and do not arise in a vacuum. You need to visit hospitals, and talk to technicians and doctors just as Veronesi did.

Veronesi firmly held that only the scale and scope of multinational corporations could assure the long-term survival not only of his start-ups but all those belonging to Mirandola's medical-device cluster[7] (Agarwal, 2017; Baron, 1999; Biggiero, 2002). Accordingly, grooming start-up firms to rapidly expand to then become targets for multinationals was a rule of thumb:

> I always told my collaborators that you must be ready to let go and start anew. I was keen on selling my companies to larger corporations and then starting new businesses […] many of my collaborators turned entrepreneurs have followed the same approach that I have been taking throughout my career (Mario Veronesi, personal interview).

Most of the companies founded by Veronesi's disciples followed this rule. For instance, one who followed in his tracks was Pietro Vescovini, a skilled machinist, a former employee and subcontractor. He sold his firm Eurosets, which made oxygenators, in 1991, which later became completely absorbed by the vertically-integrated, private, Italian hospital and medical-supply firm GVM. Bellini, Veronesi's first protégée, sold two of his medical-device firms to foreign multinationals: one purchased by the American, medical-device giant Baxter and the other by the privately held German B.Braun-Carex. RanD, Bellini's current company dedicated to artificial-liver technology, once was partly held by Medtronic (Cattani, 2017; Giuliani, 2011). Meanwhile some of Belllini's former employees from Miramed, who ended up with its research and development division after the rest was sold to Baxter, sold out to the German Fresenius, today the world's largest dialysis manufacturer and service provider. Other former Bellini employees turned entrepreneurs include Graziano Azzolini, who sold his start-up Sidam to the Italian conglomerate Synopo in 2015 (Giuliani, 2011) and Franco Menarini who sold PEC to the Danish multinational Codan in 2006 (Consoli and Mina, 2009).

Another rule of thumb was "sell but retain control". It meant holding on to promising but neglected technologies, which could be a springboard for founding new medical-device firms. A Veronesi intimate explained it best:

> "Veronesi had a simple rule he used to repeat to his collaborators: 'the fastest way to start a company is to rely on the know-how forgotten or just abandoned by another company'. So […] the (second) company started-off very simply by marketing products we had 'imported' from Veronesi's prior company. These products were of no interest to the parent company who had deleted them from their catalog. The approach was straightforward: start quickly, retain key people and bypass intellectual property issues by leveraging forgotten technologies! (Alessandro Calari, personal interview)

Leonardo Bigi, the chemist, further illustrated the same point recounting the creation of Veronesi's third and fourth company:

> Right after selling Dasco we were working on a new type of dialyzer but the people at Sandoz (the Swiss acquirer of Dasco) told us they were not interested; what they had worked just fine. So we decided we would develop it ourselves. Exactly the same thing happened in cardiac surgery. We had been tinkering with a new oxygenator but Bellco was not interested. So we said 'we are going to do it;' and they replied that we were free to do it and that it was our business (Leonardo Bigi, personal interview).

Several of Veronesi's early collaborators provided further evidence pointing to his heuristics' influence upon their subsequent start-ups. Alberto Cavicchioli worked with Veronesi in the 1970s, forming Biofil along with Giorgio Mari to improve and market apheresis (a technology to separate blood into its component parts), something that Baxter had jettisoned. When Gianni Bellini quit Bellco to create Miramed he kept designs for pericranial infusion sets that his former employer had discarded. Mario Atti, an industry veteran, highlighted how this approach persisted even after the passing of the first generation:

> Although I was never part of the Veronesi team […] I followed in his (Veronesi's) steps when I founded Aferetica. With my co-founder, I identified an unexploited opportunity in our prior business and we ran with it to create our company (personal interview).

Opportunistic outsourcing was another rule of Veronesi. Outsourcing in Italy usually cuts labor costs and taxes, affords greater economies of scale and intensifies the division of labor, all while speeding and expanding interfirm-knowledge transfers (Lazerson, 1988). Veronesi internalized this practice - e.g. outsourcing plastic tube manufacturing, complementary services, prototype support, etc. – early on to minimize investments and reduce complexity.

The transmission of these simple rules from the ancestral founder to subsequent entrants underpinned the early development and growth of the industry, providing a set of succinct, straightforward, hard-and-fast entrepreneurial principles that provided direction but without strict confines (Shah and Oppenheimer, 2008; Pieper et al., 2015). In summary, Veronesi's entrepreneurial successes and ideas stimulated a number of his early collaborators to strike out on their own. Their firms would extend the trajectory of Veronesi's model, characterized by similar processes, practices and relationships with suppliers, customers, and collaborators.

[7] This conviction was bolstered by multiple factors (a) the increasing realization that entering the most lucrative international markets, especially the US one, meant facing daunting regulatory challenges, requiring depth and breadth of complementary resources that were well beyond the capacities of small new entrants (b) the limited structural availability of investment capital and managerial capabilities which could support medical device firms aiming for global reach (c) his personal aversion to the kind of complex and tiered organizational structures needed to scale companies globally (d) Veronesi also referred to Italian cultural attributes of individualism and familism, which Fukuyama (1995) and others have extensively discussed, as reasons for the dearth of Italian global companies. As he colorfully explained to us: "Italy has few multinationals because we are soloists; we like to perform alone. Just look to the world of music; we have some of the world's greatest violinists and pianists, but not orchestras"

Table 2
Acquistions of Veronesi' compnaies by MNCs.

Company	Founding year	Acquisition year	Acquirer
Dasco	1965	1969	Sandoz
Bellco	1973	1976	Enichem
Dideco	1978	1986	Pfizer
Dar	1986	1993	Mallinkrodt
Starmed	1992	2008	Intersurgical

4.3. Phase 3: Attraction

As noted earlier, four years after Veronesi initiated production of Italy's first kidney-dialysis machines in 1965, Sandoz acquired Dasco, wanting a bolt-on medical-device company for their international pharmaceutical business (Agrawal and Cockburn, 2003; Chiles, 2004; Golden, 1992; Goldoni, 2019). Sandoz's acquisition became a beacon to other multinationals, customers and entrepreneurs, alerting them of the existence of a new medical-device center. Since then Mirandola has continued to attract attention from new firms, producing a dynamic medical-device market. According to one informant charged with Sandoz's acquisitions of Dasco:

> We bought Dasco because we saw a great product portfolio. Veronesi had been developing an array of innovative products including the DIALIX, a breakthrough artificial kidney.

Although Dasco was already Veronesi's third firm, the sale to Sandoz put him on a path to become not only a Schumpeterian entrepreneur but a serial entrepreneur (Agrawal and Cockburn, 2003; Bell and Pavitt, 1993). Each of the subsequent companies he launched also eventually become multinational subsidiaries (see Table 2). According to Bellini:

> Sandoz's acquisition of Dasco was the watershed event. After that, in the late seventies and onwards the multinationals started to make massive acquisitions here. We were pioneers in kidney dialysis, and they wanted fast entry into the marketplace.

In 1972, Veronesi staffed Bellco, his new start-up, almost entirely with former Dasco employees. Some he rewarded with both shares as well as high executive positions (see Appendix F, Fig. F3, for a picture of the founding team). Bellco soon developed the Unimat BL760, a qualitatively different and advanced dialysis machine with completlely disposable plastic tubing that could be completely personalized to the needs of a single patient. Conceived and executed in large measure by Alessandro Calari, a brilliant technician brought in from Bologna, it also showed the advantages of bringing in outsiders to an otherwise purebred Mirandola team. Calari's Unimat overnight rendered Sandoz-DASCO's rudimentary ones essentially worthless. But despite Bellco's technical achievements, it too would soon end up like Dasco. In 1976 Veronesi sold a majority of his shares to Snia Viscosa - a unit of the Italian state-owned EniChem that was later sold off to FIAT (Golden, 1992; Gompers, 2005) - that was shopping for medical-device firms. A former EniChem product manager explained:

> At some point it became clear that something special was happening in Mirandola….Bellco was pioneering dialysis technology…especially they were spearheading solutions in low invasiveness recirculated dialysis….and we wanted to tap into this know-how.

Following the playbook used at Dasco, part of Veronesi's team was busily founding Dideco, a few kilometers up the road past Mirandola's historic center, while Veronesi was still managing Snia Viscosa's new Bellco subsidiary. Dideco was to provide services as well as research and development for Snia Viscosa, whose state managers possessed neither the ability nor the interest in creating new products. So in 1978 when Veronesi's contract as interim managing director ended, he sold his remaining shares to Snia Viscosa and joined his partners at Dideco, already busy manufacturing oxygenizers based on an unwanted Bellco patent voluntarily surrendered to Veronesi. An oxygenator is an extracorporeal-disposable plastic device that replaces carbon dioxide with oxygen in the patient's blood during cardio-surgery. As with the Kiil dialysis machine, Veronesi's technicians had re-engineered a Colorado company's stainless steel oxygenator into an improved disposable plastic one (Bermiss, 2017).

As Dideco's oxygenators sales soared the American pharmaceutical company Pfizer seeking to expand their medical device offerings placed Dideco on its shopping list. And in 1986 Veronesi sold it to them. But mounting legal expenses and organizational headaches arising from deaths caused by defective heart-valve implants manufactured at its Shiley California subsidiary, so frightened Pfizer that it jettisoned their entire medical-devices portfolio. In 1992 Sorin, an Italian multinational that was then part of the Snia Viscosa FIAT conglomerate that had earlier swallowed Bellco, snapped up Dideco from Pfizer along with its Shiley heart-valve subsidiary, which fit nicely with its own Italian heart-valve operations. Dideco's original oxygenator still generates most of Sorin's profits despite multiple changes in ownership and organization, (Baker, 2007; Baker and Nelson, 2005; Bornstein and Licinio, 2011). In addition to dialysis and cardiac-care products Veronesi's team achieved breakthroughs in manufacturing other extracorporeal medical devices (see Appendix C).

First at Bellco and then later at Dideco, they also developed machines for apheresis, another extracorporeal process using centrifuges to separate blood into its component elements: plasma, leukocytes and erythrocytes. Parallel in time, Haemonetics, a Massachusetts company, was doing similar work that put technicians from both companies in regular contact. But while Haemonetics' apheresis technology eventually became a multibillion-dollar business, Dideco's new Sorin owners abandoned it. And in contrast to their dogged pursuit of promising technologies ignored by multinationals, Veronesi and his collaborators this time moved on without it. But while still at the helm of Dideco Veronesi and his team gained first-place in Europe and second place in the world for sales of oxygenators used in pediatric-cardiac surgery.

No sooner had Veronesi sold Dideco in 1986 to Pfizer he became CEO at Dar, where his team were already manufacturing plastic respirator masks. Acquired first in 1993 by the American multinational Mallinckrodt (Buenstorf and Fornahl, 2009; Denis, 1996), after a series of corporate restructurings it became Covidien before Medtronic acquired it in 2014. It still manufactures in Mirandola (Consoli et al., 2016). Shortly before retiring from the industry in 2008, Veronesi together with his long-time partner Libero Luppi established Starmed a firm fabricating disposable, plastic ventilation hoods to aid in respiration. The British multinational Intersurgical (Golden, 1992; Hannan and Freeman, 1986) acquired it shortly thereafter. It too still fabricates them in Mirandola.

Worthy of mention is that the presence in Mirandola of large foreign multinationals is most anomalous for Italy, which attracts proportionately less foreign direct investment than any other western European nation. Today Baxter, Medtronic, Fresenius, B. Braun and Elcam disproportionately account for half or more of Mirandola's medical device work force and revenues. This too is another anomaly in a country whose industrial landscape is thick with small- and medium-sized family-owned manufacturing firms but few large ones (Italy defines a firm with more than 500 employees as large.) Allying himself with international, medical-device giants and surrendering decision-making and financial control to distant corporate boards, Veronesi very much rejected the everyday entrepreneurial culture that uncritically accepted the still rather widespread political and economic Italian industrial ethos that Italy can prosper without foreign investment and large vertically-integrated corporations, an approach popularized abroad in the 1980s by Piore and Sabel (1984).

Veronesi instead preferred to exchange Mirandola's technology and knowledge for fast injections of investment capital along with access to big, new markets. As technological gatekeepers (Giuliani, 2011) multinationals brought expertise to production processes and logistics as

well as advanced budgetary software, allowing precise and instantaneous feedback about financial costs and revenues (Biggiero, 2002). All of which were competencies in short supply in Veronesi's start-ups. The multinationals also contributed to the professionalization of the labor market by recruiting Italian managers from outside the local area (Aldrich (1999); Aldrich and Fiol, 1994; Cattani et al., 2017). Much as Veronesi and his lieutenants bemoaned the demise of the start-ups' spontaneous, inventive and creative culture following the arrival of the corporate bean counters, they nevertheless acknowledged that the multinationals' new organizational methods gave them the tools to finally learn the exact production costs of each and every medical device. They also recognized the facility and expertise with which multinationals satisfied the American FDA's demanding regulatory regime, helped by their deep pockets for building costly clean-rooms and financing exacting testing procedures. On the other hand, several owners of smaller but still quite successful firms reported that because financial and organizational limitations impeded them from meeting FDA testing procedures, they could not export to America

Recurring community fears that multinational ownership would lead to corporate off-shoring of jobs to gain competitive advantages have yet to be proven. Despite the endless game of musical chairs played by multinationals as they buy and sell firms in Mirandola, so far only one multinational - Baxter-Travenol - has ever closed its plant and moved it elsewhere. But even in this case, Bellini's three colleagues managed to spin off the firm's most valuable activities, eventually selling them to the German multinational Fresenius. And strengthening the musical chairs' metaphor, in 2014 Baxter returned to Mirandola to buyout the Swedish multinational dialyzer manufacturer Dasco Gambro (Alvarez et al., 2015; Avnimelech and Feldman, 2010; Baker, 2007; Clemens and Cook, 1999; Feldman et al., 2019). Mirandola's large multinational presence has produced a medical-device market that is complex, articulated and technologically heterogeneous (Buenstorf and Klepper, 2009; Cameron, 2002; Cooke, 2007; Fligstein, 2001), all indications of dynamism and continuity (Powell and Sandholtz, 2012). Furthermore not only have many small firms prospered selling services and niche products, but coinciding with the importance given to economies of scale a number of specialized firms now manufacture the customized machines needed to produce vast quantities of medical devices.

5. A stylized model: the anchor-entrepreneur as industry catalyst

The empirical analysis in this paper shows the dynamic process through which a pioneering entrepreneur can shape industry formation. Fig. 3 provides a stylized model of this process that revolves around the anchor-entrepreneur.

Following Agrawal and Cockburn (2003) and Feldman (2003) we borrow the anchor concept from the real-estate industry, where it refers to persuading prestigious putative tenants to rent space in shopping malls, especially new ones seeking to attract smaller, more specialized shops (Eppli and Shilling 1995). Following this approach, we suggest that Mario Veronesi acted as an anchor, engaging with and catalyzing others to generate collective resources. Others have shown how organizations influence the processes of value creation. Powell et al. (2012) refer to "anchor-tenants" as public organizations that foster interactions among disparate parties and reap community-wide benefits. In examining organizations that mediate across co-specialized firms, Dhanaraj and Parkhe (2006) refer to "orchestrators" who nourish the ecosystem. Similarly, Iansiti and Levien (2004), who drew on bio-ecology to showcase a specific firm's centrality in advancing the organizational diversity of a technological community, employed the concept "keystone." Likewise, anchor-entrepreneurs signal pioneering individuals who undertake economic activity within a defined area, triggering widespread social transformation (Alvarez et al., 2015). In our particular case, evidence points to three generative processes where anchoring occurs: bricolage, second-hand imprinting and beaconing.

In the early 1960s in Mirandola, Veronesi unconsciously performed bricolage by unearthing buried resources, exposing unknown capabilities, and unveiling hidden markets. He did what anthropologist Claude Levi-Strauss (1967) called "making do with what's on hand." Extending Levi-Strauss' concept to value creation, Baker and Nelson (2005, p. 333) observed that resource-constrained entrepreneurs in the Veronesi mold also perform bricolage by "making do by applying combinations of resources at hand to new problems and opportunities." Combinations may be a result of individual (Baker, 2007) or collective efforts (Garud and Karnoe, 2003). In our case, Veronesi combined a few resources to unlock new sources of value. Here, three features of bricolage standout. First, resource scarcity; in a world of scarcity a constant challenge for entrepreneurs is making something from nothing. Baker (2007, p. 705) explained: "Making use of a resource because it is available cheaply or for free, rather than because it is the right resource, and then combining it with other resources to take advantage of some new opportunity, exemplifies bricolage." Second, Veronesi overcame resource constraints by ignoring prevailing norms governing their use, opting for "interpretive flexibility" (Star, 2010), which is inherent in local conditions and in objects where unified meanings do not exist. Here he combined readily available means to attain novel solutions and spearhead efforts to generate new resources. Third, by listening attentively to medical professionals

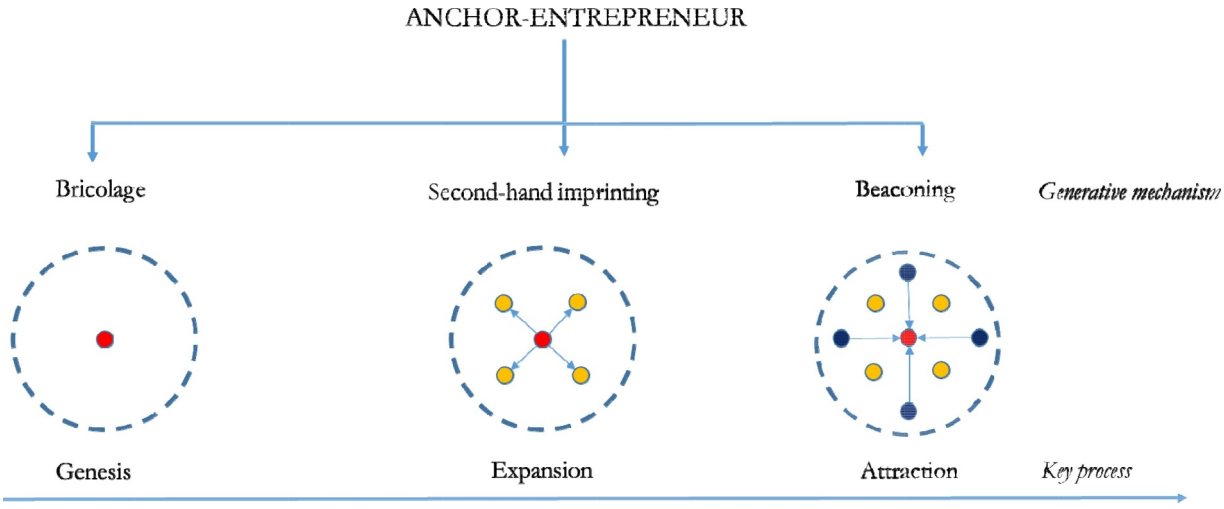

Fig. 3. Anchor-based model of industry catalysis.

recount daily problems in their practices, he perceived and articulated needs that markets failed to address (Von Hippel, 1986; Shah and Tripsas, 2007; Shah and Mody, 2014). These rich information exchanges with doctors and nurses about "bed to bench" applications produced the knowledge to improve dialyzers and other devices.

Toward the end of the sixties after having tinkered with, tested, and proven his novel entrepreneurial model, Veronesi transmitted his ideas, practices and entrepreneurial heuristics to his collaborators in a manner reminiscent of an imprinting process. Organizational imprinting theory suggests that individual and organizational responses to environmental conditions persist long after changes in the environment. Recent elaborations of the imprinting theory, as previously noted, advance the possibility of a form of second-hand imprinting; an active social transmission process where organizational members imprint their actions and ideas on new members (Marquis and Tilcsik, 2013; Tilcsik, 2014). According to Simsek et al. (2015) the basis for this idea is that individuals serve as a "summation and product of their circumstances and, as such, represent a potential conduit by which the unique circumstances of time and place are transmitted to the firm". Consistent with this argument are findings across a variety of settings that individuals exposed to entrepreneurs are more likely to start their own business (Stuart and Ding, 2006). Moreover, prior workplace experience influences how the division of labor, the allocation of authority and the design of operational routines operate in new workplaces (Phillips, 2002; Gompers et al., 2005; Klepper, 2007; Garnsey et al., 2008; Feldman et al., 2019). The organizational genealogy research of Ellis et al. (2017) on the Israeli ICT industry illustrates this process by demonstrating how workers in firms established by some ancestral founders not only inherited imprinted entrepreneurial knowledge from them, but that they themselves became repositories of knowledge for their own progeny. Ferriani et al. (2012) as well as Feldman et al. (2019) have also provided evidence of intergenerational transmission in the internal selection processes of new ventures that regulate the use and deployment of inherited knowledge. Similarly, Snihur and Zott (2020) document imprinting processes where the cognitive orientation, thinking and entrepreneurial aspirations of key members become embedded in the cognition of other members. In a similar vein Jaskiewicz et al. (2015) advance a theory of transgenerational imprinting where the entrepreneurial spirit of incumbent generations may imprint the next generation, extending their entrepreneurial proclivities to future entrepreneurial behavior. These accounts coincide with the entrepreneurial imprints traceable to Veronesi: simple, succinct, straightforward, hard-and-fast entrepreneurial heuristics (Shah and Oppenheimer, 2008) perpetuated across organizations (Pieper et al., 2015). Indeed, a genealogical lens reveals that Veronesi's former employees who relied on his heuristic repertoires founded nearly all of the companies during the industry's early period. Meanwhile traces of those imprints remain visible and vivid up until these days.

Thus, by the end of the 1970s not only Veronesi's first company served as a billboard for his generative signs. Former employees who metamorphized into entrepreneurs modeling their own ventures pursuant to their inheritance also did. The reiteration of these same entrepreneurial notes and chords was recognized in far off places, attracting resources and capabilities to Mirandola from outside the region. The outcomes, actions and events triggered by the anchor showcased the industry. Drawing on signaling research, Bermiss et al., 2017 suggest that the unique actions, characteristics and social saliency of organizations can shape large-scale entrepreneurial processes, attract resources and open a path for new entrants within an industry. Defining these singular organizations as beacons underscores how they signal to other players a domain's attractiveness and the potential benefits of both founding and supporting organizations within that domain. Although the performance of beacons is contextually novel and unique, they illuminate concrete and easy to process information, which fosters firms and collective growth through attraction (Bermiss et al., 2017). In conclusion, anchor-entrepreneurs "turn on" a beacon that triggers attractive light and accelerates entrepreneurial waves of activity.

6. Discussion and conclusions

Challenging past research that emphasizes the planned and programmed nature of industry emergence, our study reveals that many generative events are actually random steps taken by pioneering actors immersed in bricolage. Should their initial efforts succeed , they will be anchors for the less bold, the less adventurous, the timid; those sitting in wait to unleash their animal spirits. Next we discuss how our study contributes to the literature on industry emergence and entrepreneurship. We conclude by delineating policy implications and avenues for future research.

6.1. Research on industry emergence

Our paper offers insights into early stage industry evolution and sheds some light "about the sources of industry knowledge for entrants whose founders have no prior experience in the industry" (Mostafa and Klepper, 2018, p. 627). Contrary to the prevailing wisdom that novel industries emerge from the skill sets of those already embedded in similar or parallel industries, this case shows that even those with minimal or no direct industrial experience can spawn imposing industrial organizations. Kaplan and Tripsas (2008) propose that these outcomes may sometimes be traced to the newcomers' freedom from the baggage of existing conventions. Perhaps Powell and Sandholtz (2012, p. 384) come closer when they write that the contribution of newcomers is that "their baggage comes from their domain of origin, not the realm they are entering". Baggage transferred to a new domain can contain surprising opportunities for refunctionality and novelty (Cattani et al., 2017). After all, Veronesi had no technological nor manufacturing background. Nevertheless, his wholesale pharmaceutical and retail-drugstore experience compensated for an otherwise meager medical-device resume, which rewarded him with a dense network of patients, pharmaceutical executives and physicians. Not to mention training him to listen to customers and translating their frustrations, problems and needs into tangible products. Veronesi's bricolage (Baker and Nelson, 2005) marked by interpretive flexibility and extensive user-engagement (Von Hippel, 1986) proved central to this creative process, but two other key generative mechanisms triggered by Veronesi were second-hand imprinting and beaconing.

We observed that Veronesi and his lieutenants stamped long-term imprints on Mirandola's medical-device industry that to varying degrees influence events today (Stinchcombe 1965). His simple rules of starting new ventures leveraging knowledge assets overlooked by existing companies; developing ties to medical specialists; encouraging skilled, entrepreneurial employees to strike out on their own; poaching founding team members from their organizations; subcontracting lower-value added activities such as plastic-tube assemblies to minimize costs; and promoting knowledge transfers among firms remain prevalent in Mirandola today. The routinization of these practices provided Mirandola with the tools to strengthen its identity and sharpen its industrial profile. At the same time, by following Veronesi's approach to expanding economies of scope for plastic disposable products, stimulating contractors, and maintaining close relationships with physicians as they experimented and tinkered with new ideas, Mirandola so far has steered clear of the deadly shoals of inertia that have sunk many embedded clusters (Grabher, 1993; Ferriani and MacMillan, 2017). These findings bolster the organizational-imprinting literature, showing that founders may transmit their entrepreneurial proclivities as they shape organizations and influence the behavior of other members through a process of second-hand imprinting (Marquis and Tilcsik, 2013). Imprinting's persistence may not be merely the outcome of inertia and the environment. It may result from actively transmitting imprints within and across organizational boundaries (Johnson, 2007; Pieper et al., 2015; Feldman et al., 2019). On this point our evidence exposed a variety of recurring heuristics (Bingham and Eisenhardt, 2011; Bingham and Haleblian, 2012) that guided Veronesi's

serial entrepreneurial efforts, and which were subsequently perpetuated by his collaborators when they spawned new firms. Despite the large-scale consequences that second-hand imprinting may unleash, we should note how little is known about the dynamics and mechanisms enabling it to transcend generations (Ellis et al., 2017).

Our account of imprinting processes differs from those that emphasize the rigidity of social, institutional and cultural structures in determining developmental trajectories. Instead we bring agency to the fore. Our research shows how founders and other economic agents are active participants not passive "conduits through which economic, social, or cultural forces systematically shape organizational blueprints" (Baron et al., 1999, p. 542; see also Johnson 2007; Snihur and Zott, 2020). They constitute the granular elements forming the mechanisms of organizational reproduction and inheritance of localized industry (Klepper, 2007, 2010; Buenstorf and Klepper, 2009; Ferriani et al., 2012). As pointed out by Marquis and Tilcsik (2013, p. 232), "recognizing that history matters is of little help unless we understand how it matters" (but see also Kimberly and Bouchikhi, 1995; Tilcsik, 2014). A fine grained historical analysis of pioneering founders and their firms is crucial to record transformative social and economic change (Drori et al., 2013; Alvarez et al., 2015; Lippmann and Aldrich, 2016; Aversa et al., 2020).

The anchor-entrepreneur serves as an industry catalyzer by acting as a beacon for other entrepreneurs (Bermiss et al., 2017). Here "a single organization [...] attracts widespread attention, resources and signals the prospects for entrepreneurship" (Bermiss et al., 2017, p. 547) by exhibiting exceptional and conceivably replicable outcomes. Our data suggest that Veronesi's new companies and technologies proved potent attractions for drawing new resources and capabilities to the region. Once it earned the attention of multinationals, Mirandola's industry became a virtuous circle as more resources and capabilities flowed in. Expanded investments increased not only economies of scale but led to organizational enhancements required to export to the FDA-regulated American market and to introduce modern fiscal and budgetary monitoring methods (Giuliani, 2011). The expanding market for medical devices largely underwritten by multinationals also fattened many independent firms who benefitted from the resulting expansion of the division of labor and rich knowledge spillovers.[8] And contrary to the expectations of many, the multinational subsidiaries have demonstrated remarkable economic stability. At least up to now the "specter of decapitation" that Cooke (2007, p. 133) prophesized for companies like them has not materialized.

6.2. Research on institutional entrepreneurship

Our findings resonate with institutional entrepreneurship's understanding of entrepreneurs as "active and artful exploiters" (Lawrence and Suddaby 2006, p. 219) of opportunities. Veronesi appeared cut from this cloth, endowed with the ability to "induce cooperation in others" (Fligstein, 2001, p. 105), while opportunistically pursuing a few, well-defined projects he had stumbled across. Yet appreciating his rapid success would be hard to do without accounting for the crucial enabling conditions that enhanced his agency. First, there were the unique regulatory "testing regimes" (Yaqub, 2017) within which he and his ragtag band of young technicians maneuvered for many years. What distinguishes medical technology from other technologies is that safety considerations remain paramount throughout the production process, since malfunctioning technologies can be harmful or even deadly. Consequently, deviations from existing traditions of practice are constrained; testing and redesign cycles are heavily regulated, and as a result validation processes may be onerous (Yaqub, 2017, 2018; but see also Consoli and Mina, 2009; Consoli et al., 2016). Today, for instance, regulatory approval of a high-risk medical device is the endpoint of a lengthy and uncertain process with costly outlays that may even exceed $100 million (a large component of which is the cost of clinical research). These represent tough barriers for pioneer entrants (Stern, 2017). In Italy however official government regulation and testing of medical devices dates only from 1990, some twenty-five years after Veronesi had started producing dialysis machines. And within the European Union it was not until 1993 when the Council of European Communities issued the Medical Device Directive introducing the CE Mark to regulate medical devices in the European economic area. Not even the respected American Food and Drug Administration (FDA) regulated the testing and approval of medical devices and instruments until 1976. This followed some well-publicized medical device failures, which prodded the U.S. Congress to pass the Medical Device Amendments Act, establishing the current regulatory framework. Among our informants there was a consensus that the early, lax regulatory conditions gave them wide latitude for experimenting, innovating, maneuvering, and shaping the institutional environment to a degree unimaginanable today. This point is underscored by Cameron's history of modern dialysis: "Dialysis could not be invented nowadays – or at least clinical dialysis could not be invented – because of the regulatory regimes now in place" (2002, p. 24).

Italian legislative passage in 1967 (some two years after Veronesi's entry into hemodialysis) mandating the Ministry of Health (then administered by INAM) to reimburse hospitals for kidney dialysis expenses represented another crucial enabling condition. It underpinned the sudden surge in patients undergoing dialysis. One year later Dasco already had installed 1000 dialysis units in Italian hospitals, crowning its success as the leading European artificial kidney manufacturer (Geatti, 2018, p. 16). Similarly, demand in the U.S. skyrocketed in 1973, following the federal government's extension of Medicare coverage to all dialysis treatments under the End-Stage Renal Disease (ESRD) program (Peitzman, 2007). Prior to that, the prohibitive costs of dialysis - about $40,000 annually per patient - led to both strict rationing and limited availability of dialyzers (McBride, 2009). The justification for this unprecedented program that extended subsidized dialysis care to all was that the kidney dialyzer was a proven medical "miracle" that literally saved lives[9] (Kolata, 1980). Because of the ESRD program, treatment centers expanded exponentially, fueling rapid industry growth, and accordingly evermore interest in the technologies being hatched in Veronesi's network of companies.

These observations point to a less actor-centric narrative, one more sensitive to meso- and macro-level economic, social and political forces. In this realm the success of entrepreneurial projects depends far less on an individual's agency. Such a narrative affords reasonable "potential

[8] So anxious were the first wave of multinationals to have a piece not only of Mirandola's technology but of its entrepreneurial spirit and creativity that some delayed fully integrating their newly acquired subsidiaries into their organization until after Veronesi and his progeny resigned as managing directors. Today it is hard to detect a "third-hand imprinting" extending beyond incremental innovations. Nevertheless there are some indications of qualitatively different medical devices emerging such as those required in the field of molecular medicine (Bingham and Eisenhardt, 2011; Bingham and Haleblian, 2012; Bresnahan et al., 2001; Dietrich and Gibson, 1990; Feldman and Francis, 2004; Fligstein, 2001; Garnsey et al., 2008). These developments, which have sometimes arrived in Mirandola from external actors, unconnected to any multinationals, offer new interesting research avenues. Should they become more tangible and find support within the existing ecosystem, they will prove an impetus for research that will both reposition and rejuvenate Mirandola.

[9] Nephrologists concur in identifying the mid-sixties as the golden age of dialysis (Trachtman et al., 2014; Geatti, 2018). Before the diffusion of artificial kidneys and hemodialysis techniques patients affected by kidney failure faced no other alternative than death: they quickly become uremic, poisoned by the body's own wastes, and perished after experiencing extremely painful symptoms (Holden, 1980). Already in the early seventies, end-stage renal disease patients undergoing regular dialysis were able to keep up their housework or hold part-time or full-time jobs (see also "Dialysis or Death", The New York Times, March 7, 1976)

for outcomes which are not necessarily those originally intended by the actors involved" (Hardy and Maguire, 2008, p. 206, but see also Storey, 2011). Thus, while incorporating the role of agency, it reduces risks of swinging too far in that direction, downplaying the particular context within which humans create new entities and the kinds of "blundering" that March (1971), Weick, 1979 and Aldrich (1999) have described. In this way, attributions of causality to one or even a handful of actors are more likely to be problematized, paying more attention to the emergent, multifaceted, and distributed nature of the entrepreneurial process. Looking for emergent outcomes does not leave human agency out; far from it. But humans as Aldrich (2010, p. 348) humorously warns, "resemble King Lear more than they do Rocky Balboa."

6.3. Policy implications

Our findings have implications for policy and the debate about the proper role of the government in promoting entrepreneurship and targeting industries for development. One possible implication is that identifying, nurturing and developing industrial opportunities may best be left to entrepreneurs. Unfortunately, pioneering entrepreneurs with characteristics akin to those of Veronesi are too often invisible to planners intending to foster new industries, too often standing outside the conventional political field of vision. One in which entrepreneurship is understood as a function of the state directly or indirectly developing the infrastructure and surrounding economic conditions. Bresnahan et al. (2001, p.842) capture the essence of this approach. They write that not only does new industry require first "building the economic fundamentals for an industry or technology;" but afterward there remains the challenge of "finding the spark of entrepreneurship to get it going." We found no evidence of this in Mirandola. Indeed Mirandola's industrial trajectory suggests reversing that process: It is individual actors with the capacity to create, diffuse, and creatively exploit knowledge who lay the foundations of industry emergence. Policy interventions should be more sensitive to the early identification of these actors and "their role in making it happen" (Sarasvathy, 2004: 520). For example, rather than merely focusing on encouraging startups, policy may need to bet more selectively on experienced entrepreneurs who can catalyze resources and competences by becoming involved in creating additional ventures. Overlay mapping techniques as well as other scientometric approaches aimed at the early detection of weak signals or outliers in technological and categorical space (Rotolo et al., 2015) could offer policymakers a valuable toolkit. Recent techniques for identifying nascent seeds of new industries (Ferriani et al., 2016; Roe and Potts, 2016) could also prove useful in this endeavor.

What policy inputs could the technological trajectory experienced by Mirandola in the early 1960s offer to today's late industrializing countries? To address this question, we note that such a trajectory benefited from the concatenated accumulation of production and technological capabilities (Bell and Pavitt, 1993). The substantial overlap of the knowledge base of both facilitated this process. In other words the knowledge required to produce the first dialysis machines was not inaccessible to many of the people who used and operated them. Consequently, the latter process provided a basis for learning about the former. Indeed in the early days of dialysis medical practitioners like Kiil in Norway, Confortini in Italy, or Scribner in the USA used any available components to construct rudimentary dialysis equipment (Blagg, 2007; Cameron, 2002). Sausage casing, industrial pumps, and other non-medical components were employed to build the first crude, dialysis prototypes. In sparking the entrepreneurial wave that seeded the medical-device industry, Veronesi relied extensively on these prototypes and used them to guide his trial and error efforts (McBride, 2009). Today's specialization has created too vast a gulf between the kinds of competencies required to use and create given technologies for any single actor to be able to cross this chasm (Bell and Pavitt, 1993). The replication of this path for later entrants seems therefore unlikely. A modern day alternative to linking technological capability and accumulation of production capacity could be the creation of dedicated social foci (Feld, 1981) where individuals from diverse domains (i.e., nephrologists, urologists, engineers, entrepreneurs, etc.) can recombine their different templates and practices through situated, collective microinteractions (Furnari, 2014). Examples of such interactive settings from other industries include the motor clubs that fueled the emergence of British motorsport in the post-World War II period by bringing together a diverse group of amateur car racers - doctors, journalists, aerospace engineers, and mechanics (Morgan, 2009; Aversa et al., 2020). Another more contemporary example is the digital fabrication labs where computer scientists, architects, and visual artists intermingle to experiment with and develop new 3D digital technologies (Walter-Herrmann and Buching, 2013).

Our case also offers interesting insights into the interplay of entrepreneurial dynamics and regulatory regimes in shaping industry formation. In many industries government approval or licensing is a prerequisite for market entry. Examples include nearly all areas of the energy, transportation and health-care industries. Yet, as we have already noted from the early 1960s and for many years afterwards, no official government regulation and testing of medical devices existed in most countries. While other studies have illustrated how entrepreneurs can take advantage of this regulatory void in nascent markets (Ozcan and Eisenhardt, 2009), perhaps more interesting here is the role pioneers play in filling such a void. Indeed in the early days, the Ministry of Health regularly invited Veronesi and his collaborators to work with them to establish the certification standards for the emerging medical technologies. As Leonardo Bigi - Veronesi's chemist - explained:

> About a year of two after I had developed a pvc plastic tube of medical grade quality that could be used with the dialysis machines, I contacted the Ministry of Health's Research Institute (Istituto Superiore di Sanità), requesting to officially register it with the government…They told me, 'Excellent! Now we can work together to establish the procedures and rules together.' So it was very easy, since those rules where modelled upon the pioneering materials that we made.

What is clear here is that regulatory interventions are a collaborative effort involving the entrepreneur, rather than being imposed in a top-down manner. Policymakers should be sensitive to the role of early entrants in contributing to the regulatory framework of emerging industries when the implications of novel technologies are still poorly understood and the yardsticks for establishing institutional legitimacy have yet to be developed. As Smolka and Heugens, 2020 (p. 656) have noted: "Public pressure on governments to regulate newly emerging fields is on the increase, urging them to reach out to entrepreneurs to reduce knowledge gaps and information asymmetries". New medical technologies will grow in importance over the coming years, and early engagement and clear communication between regulators and innovators can help shape future policies governing new product development and regulation (Kaplan and Stern, 2018).

7. Concluding remarks

Although elements of particularism have long marked Italian economic development, it would be mistaken to interpret what has occurred in Mirandola as inapplicable to other countries with different economic and legal structures. Earlier we offered suggestive evidence of entrepreneurs spearheading entirely new industries across many different domains (Lazerson and Lorenzoni, 2016). Alvarez et al. (2015) recounted how Lowell Wakefeld began the Alaska king crab industry. Mostafa and Klepper (2018) have documented the pioneering role of Daesh Garment to jump-start the Bangladesh garment industry against unfavorable conditions. Even in the field of medical devices, there is the American, orthopedic-device industry (Marsh 2012) that owes its existence in large measure to an American Veronesi. It is still located today in the vicinity of the small Indiana town of Warsaw where the industry sprouted in 1895, after the pharmacist-founder and salesman

Revra DePuy started making his first orthopedic devices. Today the various merged successor companies are capitalized at billions of dollars on the New York Stock Exchange; an evolutionary example of the change from extreme structural simplicity to organizational complexity (Simon, 2009). These examples also resonate with findings on homegrown entrepreneurs (Feldman and Francis, 2004; Avnimelech and Feldman, 2010) that served as a model of regional development by fostering local spinoffs and attracting resources. More comparative research is warranted to advance knowledge of how and under what conditions ancestral founders anchor new industries. This and related areas of inquiry could reveal further industry specific anchoring processes, yield deeper insights into the social drivers of industry emergence, and enrich our understanding of the micro foundations of industries' evolutionary trajectory.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.respol.2020.104045.

Appendix A

Table A1.

Table A1
Illustrative qualitative evidence from fieldwork and archives.

Dimension	Representative quotes
Bricolage	"From a technical standpoint, hemodialysis was not rocket science. I started manufacturing the first devices with my collaborators at Sterilplast, helped by some good craftsmen from the Mirandola area who knew their stuff. I also received vital help from a science teacher who was the head of Mirandola's only vocational school. That's how I put together my first product line" (Mario Veronesi, personal interview). "We purchased the small plastic tubes from a guy named Brambilla. Meanwhile the connectors were manufactured by Comef, located not far from here, which at the time produced plastic flowers. After just a few months I became their lead client" (Mario Veronesi, [1]) "My job at Sterilplast had basically nothing to do with my prior work….I learned primarily through trial and error and possessed a strong "do it yourself attitude". We were in constant contact with hospital personnel, especially the nephrologists who usually ran the clinical trials of the devices we were co-developing. We were all novices with very limited, if not any medical knowledge and basic technical backgrounds. We processed inputs and ideas which were coming from the US, and then manufactured our own devices based on experimentation and imitation. Sterilplast was the first company in Europe to develop these kinds of products following guidelines from Italian nephrologists. But we did not really invent anything from scratch" (Lucio Gibertoni, personal interview) "While I was observing some tests on a patient I became convinced that the technology was fairly simple. The Kiil dialysis machine was not patented and the monitor had been built using a component freely available on the UK market. It was clear to me that in order to build a market for my disposable circuits, I had to develop a full-fledged all-in-one dialysis device. So I asked Dr. Confortini to lend me the Kiil over the week-end. We worked around the clock to create a prototype which turned out to be identical to the Kiil. That is when I decided to found DASCO: Divisione Apparecchi Scientifici" (Mario Veronesi, personal interview) "The spark was ignited by Dr Confortini. Dr Confortini was in charge of Verona's hemodialysis clinic. One day he said, "Why don't you try this? I think you can do it". So we said "Why not? Let us give it a try!". At that time we were few in number, and so we were more comfortable taking risks. I knew I could deal with PVC formulations. I had a good understanding of the process. And then there was this guy, Mr Brambilla, who said, "Do not worry I know how to make a plastic tube; that is my business" (Leonardo Bigi) "We hardly used any third parties, simply because there just weren't any. Therefore we created the technology inside the firm, mostly playing with what was at hand" (Gianni Bellini, personal interview)
Second-hand imprinting	"I have been always trying to nurture and forge many small entrepreneurs. Over the years they showed me that I succeeded, as many of them did create their own companies […] I did it with my employees and they will do it with theirs" (Mario Veronesi, [58]) "In 1976 Gianni Bellini is still in Bellco, but his mind is elsewhere, absorbed with the creation of Miramed and the dream of emulating Veronesi by launching a new company […] The company would produce, at least in the very beginning, products that Veronesi in Bellco had discarded, [because] feeling they had no market potential: infusion kits, epicranial sets, disposable gloves, etc." (Goldoni, 2019, p. 24) "The managers from the multinationals were shocked by the repeated success of a bunch of peasant farmers with limited formal education and very modest backgrounds. But quite honestly we always followed the same path: we focused on projects or products that had been side-lined or forgotten by the acquiring multinational for whatever reasons (this was almost invariably the case whenever a new multinational arrived) and then manufactured them in a new company. […] For example, at the time of founding BELLCO, we found ourselves inheriting several products that DASCO no longer expressed interest: a disposable roller-type dialysis filter, a hemodialysis device not requiring sterilization of the hydraulic system after each use, a blood pump that we had been developing with the Belgian nephrologist, Professor Ringoir of Ghent. We also recruited our old collaborators employed in sales who had been laid off by Enichem […] this approach to building new companies was replicated by many of my former colleagues when they made the [entrepreneurial] jump" (Giorgio Goldoni, personal interview). "In the mid-1980s, Baxter acquired Miramed. But given the parent company's lack of interest in the project I had been working on in my free time – a filter to separate donor blood cells - I left the company along with some former colleagues and we founded Biofil" (Giorgio Mari, [54]). "When a former employee created a new company for at least 7 to 8 years afterwards there was a visible 'Veronesi imprint' permeating the new firm" (Gianni Bellini, personal interview) "In my company I behave, often without even realizing it, exactly as Veronesi behaved 30 years ago. Just to give you an example, I encourage rapid decision-making just as he used to do all the time. He used to call it "the system of super-quick decisions". If we had 10 problems we gathered in the

(*continued on next page*)

Table A1 (*continued*)

Dimension	Representative quotes
Beaconing	evening around the table and we devoted, say, 10 min to address each problem. The following day we implemented what we had decided with no hesitation. This is key to give impulse and energy to actions, and it has served me well for the past 30 years" (Gianni Bellini, [60]) "Sandoz was very interested in acquiring Dasco because of the numerous pioneering solutions that it was churning out. In the end, it was the best choice for Sandoz and Mirandola. In addition the acquisition led a cadre of experienced international managers to relocate here from Switzerland" (Giorgio Goldoni, personal interview) "We bought Dasco because we realized it had a great product portfolio. Veronesi had been developing an array of innovative products including the DIALIX a breakthrough dialyzer." (Manager in charge of M&A at Sandoz, personal interview) "B.Braun Avitum is the only company within the B-Braun galaxy to produce parenteral nutrition bags. It is the center of excellence for dialysis products because Mirandola developed worldwide leadership in this area" (Distretto Biomedicale di Mirandola: Gli effetti del sisma e della ricostruzione sulle strategie delle imprese della filiera biomedicale, p. 48). "Sandoz's acquisition of Dasco - Veronesi's second company - was the watershed event. After that, in the late 1970s and onwards, the multinationals started to make massive acquisitions here. We were pioneers in kidney dialysis, and they wanted fast entry into the marketplace (Gianni Bellini, personal interview) "Right after Gambro's acquisition of Hospal-Dasco from Sandoz we started to search for a partner to challenge its increasing market power for hemodialysis. We immediately looked at Mirandola because we knew there were unique competences in this domain. We joined forces with Bellco with the goal of creating an Italian dialysis hub" (Umberto Rosa, AD Sorin Biomedica, Il Sole 24 Ore, 4/3/1988) "Overall, from the early 1990s and until 2000 Mallinkrodt invested approximately 40 million Euros in Mirandola in addition to the cost of the M&A transaction. The US multinationals had extremely rigorous accounting practices but gave us considerable free rein on the business-development side" (Veronesi, La Plastica della vita, pp 151–152)

None of the respondents spoke English as a first language. Some quotes have been edited. A few quotes are from notes taken by one of the co-authors during the interviews because of technical problems with the tape recorder.

Appendix B

Tables B1 and B2.

Table B1
The composition of the ancestral team.

Name	Age	Competence	Background	Previous experience	Origin
Leonardo Bigi	23	Laboratory specialist	BSc, Industrial Chemistry	N	Mirandola
Gianni Bellini	21	Fluent in English	High school diploma	N	Mirandola
Libero Luppi	27	Mechanical expert	Technical school diploma	Y (Tire company)	Mirandola
Carlo Gasparini	37	Accountant	University degree, economics	Yes Certified Public Account	Mirandola
Carlo Trazzi	20	Accountant	Technical school diploma	N	Mirandola
Giancarlo Malavasi	24	Telecommunication technician	Technical school diploma	Y (antenna maintenance)	Mirandola
Romano Flandoli	33	Mechanical expert	Technical school diploma	Y (teacher at the local technical school)	Mirandola
Giorgio Goldoni	20	Fluent in German	University degree, languages	N (school teacher)	Mirandola

Table B2
The transition to entrepreneurship of Mario Veronesi's early employees.

Name	*Employee*	*Veronesi's co-founder (minority stake)*	*Entrepreneur*
Carlo Bellini	Miraset/ Sterilplast	Bellco	Miramed
Gianni Bellini	Miraset/ Sterilplast Dasco	Bellco	Miramed Diatekno Carex Rand Rigenerand
Alessandro Calari	Dasco	Dideco Bellco	/
Massimo Fini	Dideco	/	Cortek
Romano Flandoli	Dasco	Bellco	–
Giorgio Garuti	Dasco	Bellco	/
Carlo Gasaparini		Miraset/Sterilplast Dasco Bellco	Berco
Lucio Gibertoni	Dasco	Bellco Dideco Dar	Redax

(*continued on next page*)

Table B2 (*continued*)

Name	*Employee*	*Veronesi's co-founder (minority stake)*	*Entrepreneur*
Giorgio Goldoni	Mirasetr/ Sterilplast Dasco Bellco Dideco	/	Miramed
Libero Luppi	Dasco	Bellco Dideco	Cortek Starmed
Giancarlo Malavasi	Miraset/ Sterilplast Dasco Bellco		Haemotronics Berco
Claudio Trazzi	Miraset/ Sterilplast Dasco	Bellco Dideco Dar	/
Pietro Vescovini	Dideco		Eurosets

Appendix C

Table C1.

Table C1
Landmark products developed by Veronesi's companies.

Year	Product	Company
1965	Dialyzer Kiil	Sterilplast/Dasco
1966	DAS 2005 – Monitor to regulate and control dialysis saline solution	Dasco
1967	First peristaltic pump (DAS 225)	Dasco
1969	First artificial kidney	Dasco
1973	Single pass kidney dialyzer (UNIMAT)	Bellco
1979	Cell separator for hematic components (BT795P)	Bellco
1980	First European oxygenator for extracorporeal circulation (BT 795)	Dideco
1988	First hollow fiber membrane oxygenator (LILLIPUT)	Dideco
1992	First oxygenator for neonatal patients	Dideco

Appendix D

Table D1.

Table D1
Interviewees: position and number of interviews.

Informant	Role at time of interview	Prior relevant roles	Interv.
Aldrovandi Mauro	Engineer Dasco Gambro	Dasco Gambro, past employee;	2
Atti Mauro	Aferetica, CEO & Co-founder	Bellco, CSO; Gambro/Hospal, Marketing Director	1
Azzolini Libero	Dasco Gambro, Prod Head		1
Balbo Enrico	Balbo Medical, President	Early employee at Gambro Dasco, Bellco, Miramed, Dasco	1
Bellini Gianni	RanD, Founder	Founder of Miramed, Rigenerand; early employee at Sterilplast, Dasco	6
Boggio Luigi	Assobio Association, Pres.		1
Benatti Paolo	Sorin Group Italy, VP	Miramed, CFO	1
Bigi Leonardo	Freelance consultant	Early employee at Sterilplast, Bellco, Dideco, Sorin	1
Bisi Giuseppe	HMC Premedial, President		1
Calari Alessandro	Retired	employee at \, Bellco, and executive atDideco	5
Cavaliere Stefano	Managing Director, Covidien -Mirandola		1
Cavicchi Antonella	Personal assistant to Veronesi	Bellco , Didecco and Covidien	2
Cirelli Elio	Retired	CFO, DascoGambro	1
Cotti Mauro	Haemotronics, Co-founder		1
Fecondini, Ing.	Group Medica, President	President, Biomedical Consortium; started as engineer at Dasco Gambro	1
Eruzzi Silvio	Lucomed, Chairman	CEO, Haemotronics	1
Fava Vanna	Fava Vanna, Founder	subcontractor to Dideco and Eurosets, partner of Pietro Vescovini	1
Gavioli Giuliana	Tecnopolo Veronesi, CEO B.Braun, Director Quality Ins. & Reg. Affairs	Started at Biofil.	3

(*continued on next page*)

Table D1 (*continued*)

Informant	Role at time of interview	Prior relevant roles	Interv.
Gibertoni Lucio	Redax, Founder	Darex, Founder; early employee at Sterilplast, Bellco	2
Goldoni Giorgio	Retired	Early empl. Sterilpl., Bellco, Dideco	5
Gorni Maria Nora	Ri. Mos, Founder		1
Luppi Libero	Star Med, Founder	Cortec, Found; early employee Sterilpast, Dasco, Bellco, Dideco	1
Malavasi Giancarlo	Retired	Early employee at Sterilplast, Bellco, Miramed, Fresenius; Founder of Berco,	1
Mari Giorgio	Rigenerand, CEO	Founder, Biofil; Production Head, Miramed; Managing director, Fresenius	1
Menarini Franco	Menny Medical, Founder	Early engineering employee at Biofil. Founder of PEC.	2
Mirto Giuseppe and Enrico	MIBA, Founders	Subcontractors to Veronesi and others.	1
Nicolini Alberto	Journalist, CPA and industry consultant	Founder of La Plastica della Vita	1
Poggioli Paolo	Consobiomed Consortium, Founder	Founder, Kidline, Emo, Kilab, Med Italia, Medistar; Early engineering employee at Hospal-Dasco	1
Parrino Andrea	Lean, Founder	Started as engineer at Dasco Gambro	2
Raivitz Ehud	Elcom, President & CEO	Acquired Lucamed on behalf of Israeli Kibbutz Bar'am	1
Rimondi Stefano	Afretica, Founder	Early employee at Bellco	6
Veronesi Mario	Retired	Founding father	3
Vescovini Paolo	Eurosets, Founder	Early employee and machinist at Dideco, partner at Fava Vanna.	1
Zanazi Marco	Gambro,Plant Director	Engineer	1
TOTAL			**61**

Appendix E

Mirandola-specific archival sources

Press articles

(1) “Mario della Mirandola”, *Il Sole 24 Ore*, 22 febbraio 1986
(2) “Un caso italiano, nel bene e nel male”, Il Sole 24 Ore, 22/02/1986
(3) “La fabbrica della salute ha un fatturato di 137 miliardi”, La Gazzetta di Modena, 15/10/1986
(4) “Salute, un affarone”, La Gazzetta di Modena, 18/10/1986
(5) “Cuori artificiali targati Fiat”, La Gazzetta di Modena, 04/09/1987
(6) “Alla Volvo la Hospal Dasco”, L'Unità, 29/07/1987
(7) “La Volvo ha fatto un buon affare”, L'Unità, 30/07/1987
(8) “La fabbrica del cuore”, La Gazzetta di Modena, 16/10/1987
(9) “Capitale cardiochirurgica”, La Gazzetta di Modena, 04/01/1988
(10) “Così Mario della Mirandola creò il biomedicale”, L'Unità, 07/12/1988
(11) “C’è anche chi assume”, La Gazzetta di Modena, 17/12/1988
(12) “I prodotti mirandolesi cercano nuovi mercati”, Il Resto del Carlino, 1988
(13) “Il mago del biomedicale”, L'Espresso, 1988
(14) “Così Bellco sta preparando la dialisi intelligente”, Mondo Economico, 1989
(15) “Il biomedicale guarda al futuro”, http://www.biomediland.it/portfolio/il-biomedicale-guarda-al-futuro/, 1989
(16) “L'autunno che sconvolgerà Mirandola”, *Il Resto del Carlino*, 26 Agosto 1990 (http://www.biomediland.it/portfolio/432/)
(17) “Caccia grossa a Dideco”, *Il Resto del Carlino*, 17 Dicembre 1991 (http://www.biomediland.it/portfolio/caccia-grossa-a-dideco/)
(18) “Check-up all'industria della salute”, *Modena Mondo*, marzo 1998 (http://www.biomediland.it/portfolio/dffgfdg/)
(19) “La Tyco International acquista la Dar”, *Il Resto del Carlino*, 4 luglio 2000 (http://www.biomediland.it/portfolio/la-tyco-international-acquista-la-dar/)
(20) “Biomedical valley' a focal point for health product manufacturing”, The BBI Newsletter; June 1, 2001
(21) “Mirandola: Italy's biomedical valley”, Medical Device Technology, 13(5): 30–32
(22) “La boutique degli organi artificiali”, Il Giornale, 27 marzo 2004 (http://www.biomediland.it/portfolio/la-boutique-degli-organi-artificiali/) +
(23) “Mario Veronesi, l'uomo delle start up dal '66 ne ha fondate e vendute quattro”, Repubblica, 21–7–2008
(24) “Gambro, una scelta prevedibile”, *Il Resto del Carlino*, 1 febbraio 2011 (http://www.biomediland.it/portfolio/gambro-una-scelta-prevedibile/)
(25) “Da CODAN a Menny Medical, continua l'esperienza nel biomedicale”, *La plastica della vita*, N. 1 2011 – anno 7° (p. 9)
(26) “Covidien investe a Mirandola”, *La plastica della vita*, N. 1 2012 – anno 8° (p. 3)
(27) “Nascita e sviluppo del biomedicale mirandolese”, N. 1 2012 – anno 8° (inserto)
(28) “Ri.Mos festeggia la nuova sede”, *La plastica della vita*, N. 2 2013 – anno 9° (p. 23)
(29) “Il Dottor Mario Veronesi in visita alle aziende del distretto per presentare il portale www.distrettobiomedicale.it”, *La plastica della vita*, N. 3 2013 – anno 9° (p. 18)

(30) “Ivonne Gavioli, il biomedicale raccontato da chi l'ha vissuto negli anni in cui questo settore fioriva ogni giorno”, *La plastica della vita*, N. 3 2013 – anno 9° (p. 21)
(31) “Via al Campus del Biomedicale”, *Prima Pagina*, 19 maggio 2013 (http://www.biomediland.it/portfolio/via-al-campus-del-biomedicale-2/)
(32) “Un laboratorio all'avanguardia per formare esperti di biomedicale”, *Il Resto del Carlino Modena*, 21 maggio 2013 (http://www.biomediland.it/portfolio/un-laboratorio-allavanguardia-per-formare-esperti-di-biomedicale/)
(33) “Inaugurato il campus del Biomedicale”, *Qui Modena*, 21 maggio 2013 (http://www.biomediland.it/portfolio/inaugurato-il-campus-del-biomedicale/)
(34) “Il tecnopolo del biomedicale farà ripartire le nostre scuole”, Gazzetta di Modena, 21 maggio 2013 (http://www.biomediland.it/portfolio/il-tecnopolo-del-biomedicale-fara-ripartire-le-nostre-scuole/)
(35) *Distretto Biomedicale di Mirandola. Gli effetti del sisma e della ricostruzione sulle strategie delle imprese della filiera biomedicale*, a cura dell'Assessorato Attività Produttive della Regione Emilia-Romagna, dicembre 2013
(36) “Obiettivo salute – Ritratti d'impresa: Fresenius Hemocare Italia”, *Outlook*, luglio-agosto 2014
(37) “Un'impegnativa “timetable” per il nuovo stabilimento Fresenius a Mirandola”, *La plastica della vita*, N. 1 2015 – anno 11° (p. 26)
(38) “Bior Medica si allarga e scommette sul distretto biomedicale mirandolese”, *La plastica della vita*, N. 1 2015 – anno 11° (p. 28)
(39) “Innovazione per la vita il tour è partito dalla “nostra” Gambro Baxter”, *La plastica della vita*, N. 2 2015 – anno 11° (p. 16)
(40) “40 anni nel biomedicale, dove lavoro e passione si intrecciano! Intervista a Luciano Fecondini”, *La plastica della vita*, N. 3 2015 – anno 11° (p. 11)
(41) “Glomeria annuncia l'ingresso sul mercato della dialisi di nuova generazione supportata da Spindial”, *La plastica della vita*, N. 3 2015 – anno 11° (p. 17)
(42) “Open day per festeggiare il nuovo stabilimento Fresenius di Mirandola”, *La plastica della vita*, N. 3 2015 – anno 11° (p. 24)
(43) “Biomedicale per passione – Ritratti d'impresa: Sorin Group”, *Outlook*, luglio-agosto 2015
(44) “Il futuro di Bellco con Medtronic parliamone insieme a Luciano Frattini”, N. 1 2016 – anno 12° (p. 7)
(45) “Intervista a Giorgio Mari”, *La plastica della vita*, N. 1 2016 – anno 12° (p. 10)
(46) “Neuron Guard: 2,5 milini e poi il debutto”, *Corriere Imprese*, 30 gennaio 2017

Biomedical industry reports

(47) *Osservatorio sul settore biomedicale nel distretto mirandolese (prima rilevazione)*, a cura di Ricerche e Interventi di politica industriale e del lavoro, 1999
(48) *Osservatorio sul settore biomedicale nel distretto mirandolese (seconda rilevazione)*, a cura di Ricerche e Interventi di politica industriale e del lavoro, 2003
(49) *Osservatorio sul settore biomedicale nel distretto mirandolese (terza rilevazione)*, a cura di Ricerche e Interventi di politica industriale e del lavoro, 2004

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(50) Bellini, G. (2009). *Presente e futuro dell'economia mirandolese,* in Storia e progresso del territorio mirandolese. 50 anni con il “Galilei” 1959–2009, a cura di Fabio Balboni, Ubaldo Chiarotti, Giuseppe Pedrielli, Istituto Galileo Galilei editore, Mirandola.
(51) Goldoni, G. (2015). *La storia tragica dell'ascesa e caduta dei presidi chirurgici di Mirandola* (https://storiabiomedicale.weebly.com/uploads/1/8/6/1/18610776/storia_biomedicale_goldoni.pdf), Al Barnardon editore, Mirandola.
(52) Rolando, R. (2003) *The Plastic of Life: The History of the Pharmacist from Mirandola who started the Italian Biomedical Industry and created the first Artificial Kidney Made in Italy*, Edizioni Artestampa, Modena.
(53) Mosconi, F., Montella, F. (2018) *Dal garage al distretto. Il biomedicale mirandolese. Storia, evoluzione e prospettive*, Il Mulino editore, Bologna

Video interviews

(54) Carlo Trazzi: https://www.youtube.com/watch?v=jy82ZauXCBA&t=23s
(55) Mario Veronesi 1: https://www.youtube.com/watch?v=xzSUjTRmDyI
(56) Mario Veronesi 2: https://www.youtube.com/watch?v=7QAJiWTSniY
(57) Mario Veronesi 3: https://www.youtube.com/watch?v=u3mmWHTGGRo
(58) Libero Luppi: https://www.youtube.com/watch?v=nwWb4oZk_FQ&t=454s
(59) Giorgio Bellini: https://www.youtube.com/watch?v=Pj2QiBvR8kg

Appendix F

Figs. F1–F3.

Fig. F1. Sterilplast's biochemical lab: the first biochemical lab in Mirandola's history (1962).
Source: Mirandola's Biomedical Museum.

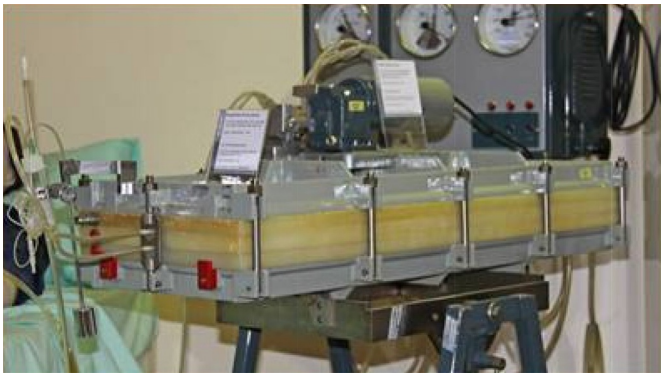

Fig. F2. DASCO's first Italian artificial kidney (1965).
Source: Mirandola's Biomedical Museum.

Fig. F3. The founding team of Bellco.
Source: Mirandola's Biomedical Museum.

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