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**UNIVERSITÀ
DI TORINO**

The Start-up city in the Circular Economy Era

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Declaration

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Eleventh of March, Two Thousand and Twenty Four

General

Layout by Nicola Farronato

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For Francesco and Andrea

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Abstract

In the new green economy era, the role of cities is getting more relevant. The cities are becoming the place for entrepreneurial initiatives either for citizens or for cities. They connect different dots in terms of entrepreneurs, investors, government, universities, citizens, and so on which have shown a great engagement in developing more social, eco-friendly and smart cities. Cities are encouraging economic and political efficiency to enhance urban development on its social and cultural nature. These cities have presented a high level of creativity, entrepreneurship and sustainability which involves companies and consumers as units of analysis. While this scenario has brought up new interesting insights in terms of theoretical advancements for entrepreneurial ecosystem literature and for managerial practices, there still is a lack of studies on how cities are getting enterprising and sustainable and in turn being an attractive place for start-ups (and ecopreneurs).

In order to emphasize this phenomenon this work charts a start-up city discourse from initial innovation and entrepreneurial ecosystem, then technological and knowledge management perspective through to real start-ups. The role played by a start-up city is explored by the lens of a combination of microfoundation and quintuple innovation helix models across the field of circular economy. A set of scientific outputs are presented along with a description of two co-founded start-ups namely: PLASY and COSMODITY. This has incredibly enriched the PhD journey and offered real cases and practices of a start-up journey in a smart city.

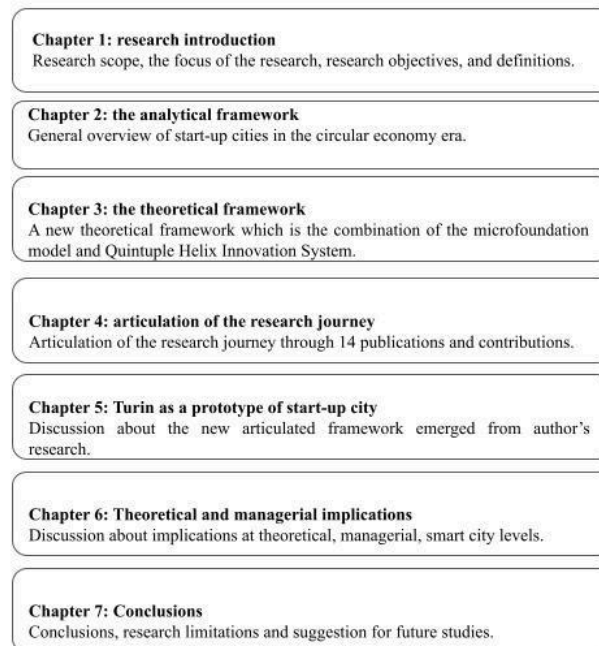
Nicola Farronato, January 2024, Department of Statistics, University of Turin

Organizing

The present paper collection adopts a traditional seven- chapter structure. By exploring start-up cities in the circular economy era through the lens of entrepreneurship, technological innovation and knowledge management, this thesis is divided into seven chapters prefaced by the first chapter which explain the scope of the study and the linkages among those papers.

As shown figure 1, each chapter represents a section of start-up city in the circular economy era, characterized by a peculiar aspect as follows:

Figure 1: research structure



Source: Author's elaboration

Chapter 1 presents an overall description of the thesis, explaining the research scope, the focus of the research, research objectives, and definitions of some key terms.

Chapter 2 offers an introduction to and general overview of start-up cities in the circular economy era. The rationale behind this analysis is explained and justified. A summary of this work is provided along with theoretical and practical contributions.

Chapter 3 analyzes the theoretical framework of this study which explains the logic behind the entire work. The present chapter offers a new theoretical framework which is the combination of the microfoundation model and Quintuple Helix Innovation System by Carayannis et al. (2022).

Chapter 4 describes the research journey of the thesis focusing on the “start-up city in the circular economy” through each of the 13 works, divided in 1 book, 4 peer to peer reviewed journal articles, 4 book chapters and 5 conference papers. The main topics are recognised and debated and the linkages to start-up cities in the circular economy era.

Chapter 5 discusses the new articulated framework which emerged from the author’s research. It offers an aggregated and critical debate on start-up cities in the circular economy and the discursive connections of traditional and modern theories. Most relevant it reveals the power-driven and advantageous nature of innovation and entrepreneurial ecosystem from which a new start-up is born.

Chapter 6 presents new theoretical and managerial implications along with smart city policy implications.

Chapter 7 concludes with research limits and future research avenues.

Research introduction

Chapter One

1.1 Introduction

The first chapter sets the present work in a scenario by describing the author's journey and the reason behind his work. This would be deep in the empirical settings and justify such choices. A summary of the whole project is provided along with theoretical and managerial implications in the field of start-up city in the circular economy era which included, entrepreneurship, green entrepreneurialism, eco entrepreneurs, technological innovation, and knowledge management perspective.

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1.2 Theoretical Background

Generating new business ideas in a city has always attracted several studies which have explored such phenomenon in terms of urban technology or urban tech (Adler & Florida, 2021); urban entrepreneurialism; technopolis; entrepreneurial city, green entrepreneurialism (Levenda & Tretter, 2019) and start-up city. These trends leverage on enterprising culture which also include sustainability which have shaped the cities in a more entrepreneurial pathway and moved them from being entrepreneurial cities to a city for entrepreneurs. There is a huge interest in supporting entrepreneurs which are demonstrating to be the source for economic

growth. For instance the European Commission has released numerous campaigns and grants to support new entrepreneurs. As they stated, “the European Commission sees entrepreneurship as acting upon opportunities and ideas and transforming them into value for others, which can be financial, cultural, or social. Our entrepreneurship policy aims to support companies, in particular SMEs, throughout their life cycle, promoting entrepreneurial education at all levels, as well as reaching out and encouraging specific groups with entrepreneurial potential” (Commission.europa.eu). In 2021 Start-up Genome individuated the highest concentration of start-ups across cities in the world, which resulted in a leading position by geographies such as Silicon Valley, New York City, London, Beijing, and Boston. However, in 2023 new entries are included also from Europe, such as London, Berlin, Paris, Stockholm, Amsterdam-Delta, among others. In this recent list, even Turin and Milan appear as one of the most developed and accelerated cities which are promoting innovation and entrepreneurship (Cillo et al., 2019). However they have noticed that companies are setting up their goals and ambitions against the sustainable development goals (SDGs). In two of my papers, I have analyzed how cities are getting more environmental friendly and so the best place for tourists’ destination, considering a green and knowledge management perspective (see Paper four 2023); and also cities are the place where new business ideas emerge combining technologies and sustainability in improving recycling consumers' behavior (Farronato et al., 2022).

Decades of studies have shown cities are engaged with the ecosystem making public- private partnerships to shape urban entrepreneurialism. Carayannis et al. (2022) introduce the helix trilogy which consists of triple, quadruple and quintuple helix to map stakeholders in ecosystems. They also stress out the nexus between the democracy of climate and knowledge,

highlighting the relevance of assuming a green behavior and perspective and intangible assets. Such a nexus is forged in the consideration that “The Quintuple Helix Innovation System intends to relate knowledge production (research) and knowledge application (innovation) to considerations of “social ecology.” (p.2280). This has spurred the interest towards the development of new business ideas (new knowledge) in a circular model that involve the reuse of tangible and intangible assets.

The circularity is characterizing the current economy due to the scarce availability of resources that has induced the need to reuse old resources from which one can create new innovations (Guyot Phung, 2019; Nohria and Gulati 1996, 1997). Stahel (2006) named this circularity a circular economy which is also accompanied by a transformation of new knowledge and skills (which call for a process of reskilling, knowledge mobility and creation). Hence, there are not simply tangible resources to be reused but also intangible ones which determine the development of sustainable innovations that includes the biosphere, technosphere, and sociosphere (Zwiers et al. 2020; Quilley 2012). In a nutshell, there is the development of eco-innovation which stimulates a new entrepreneurial thinking and enhances the adoption of the open innovation entrepreneurial ecosystem. Florida (2014) started calling for the rise of the start-up cities to analyze the fast changing and evolving geography of the venture capitalist financed innovation. In his research contribution, developed under the patronage of the Swedish Royal Institute of Technology, he elaborates about the emerging model of successful start-ups able to raise large venture capital funding based outside of main urban areas, hence observing how talent and new forms of organizations such as software remote based teams can help rethink the urban planning of a city. Later in 2020, Florida et al. further developed the concept of urban entrepreneurship focusing on the nexus between the city and the entrepreneurs which,

in specific segments like smart cities technologies, can shift the role of the city from platform for start-ups to object of entrepreneurial activity. In vein of a growing academic literature about the concept of start-up cities, the experience of Turin as city of innovation with its Turin City Lab programme seems relevant to provide valuable insights in terms of a smart city policy able to attract innovative start-ups and entrepreneurial actors aiming to shape the city of the future (Cillo et. al., 2020). The present PhD paper collection adopts the lens of a theoretical combination regarding the microfoundation theory and Quintuple Helix Innovation System by Carayannis et al. (2022). The chapter 3 describes such a framework to explain the *fil rouge* of all papers based on macro, meso and micro levels along with the relevance of the circular economy, considering the natural environment of society’.

1.3 General statement of the research problem

This work represents an inflection point in my personal journey of around 25 years based on personal and professional experiences from different sides of the innovation generation: manager of small and medium companies, start-up founder, head of the innovation team of a smart city as well as cities of the future researcher. My research interest on this problem, i.e. how will cities of the future be able to attract more entrepreneurs, enable more start-ups around them and ultimately deliver a more sustainable and high level living experience to citizens, derives from the observation that cities alone cannot cope with the constant flow of emerging and disruptive technologies. If we consider, in fact, the capacity of an average citizen to absorb and understand a new technology, we can contemplate a tendency of human beings becoming more and more tech savvy over time, and even exponential in terms of community adoption rate

of a new technology. If we look at the same trend for cities, instead, their trajectory to adopt emerging technologies seems to be more linear. Thus cities and citizens have different capabilities in adopting a new technology and the gap derived by their adoption rates can become bigger and bigger over time. Hence my research interest is to explore how entrepreneurs and start-ups can help cities to become faster in adopting emerging technologies and reduce the adoption rate gap between them and their citizens, generating higher sustainability, wellbeing and inclusion.

On completion this research will have been undertaken over a period of approximately 4 years and the rationale of this study is clear. As an entrepreneur I have a personal and professional interest that the city I live in can attract great talents and become more and more competitive when we speak about innovation and start-up opportunities. Moreover, my international network of actors belonging to the start-up ecosystem is very extensive, thanks to more than 15 years of direct experience across multiple geographies. As the former head of the innovation team of Turin city, I have gained world class insights in terms of how start-up friendly ecosystems around the globe strategize to gain the maximum impact from their entrepreneurial and researched community. Furthermore, as a former manager of small and medium enterprises I have been working for more than 10 years with local institutions and small companies to facilitate an innovation dialogue and new projects based on emerging technologies to raise. In these roles I have experienced personally the challenge highlighted as a research problem of this work. Furthermore, with seven companies co-founded as entrepreneurs, both in Europe and North America, I have gained first-hand experience about the skills, quality and behaviors required by the modern entrepreneur to build a successful business. Lastly as a researcher I have explored the literature relating to this field of study and I could find clear evidence of

many issues and phenomena which are articulated in the thesis. Owing to the diversity of my background experiences I believe to belong to a very limited group of people who can well understand entrepreneurship, has got a solid involvement in a top european city in terms of smart city and innovation policy, and has identified some of the key areas a city of the future can embed to become a start-up city.

1.4 Focus of Research

This study charts start-up cities in the circular economy era from urban entrepreneurialism to develop a city for entrepreneurs across entrepreneurship, technological innovation, and knowledge management perspectives in the scenario of circulatory economy. The key role of the city is explained in relation to some case studies of real entrepreneurs which have demonstrated sustainable development. This work aims to emphasize the relevant role of cities for entrepreneurs and for communities. Building on the results of this research a new model for supporting the big frame of the city for entrepreneurs is offered (Chapter 3) along with the foundation of two new companies, named Plasy and Cosmodity, each offering innovative services and technologies for the cities of the future.

The new model is useful to support entrepreneurs and promote entrepreneurship in a city. This model is replicable in other cities which are not already prepared to nurture new entrepreneurs. It shows challenges, limits, and benefits. This pathway is presented by the development of works (*1 book, 4 journal articles, 3 book chapters and 5 conference papers*) throughout the

PhD period. The Figure 2 presents broad range and interconnected themes that were explored in those works and discussed in more depth in Chapter 4.

Figure 1. Relevant themes explored and analyzed during the PhD journey

Work	Title	Key Themes
Conference paper one (2020)	1. CILLO, V., FARRONATO, N., SCUOTTO, V., PIRONTI, M., PISANO, P., & DEL GIUDICE, M. (2020). <i>Torino City Lab, an open innovation participatory ecosystem. The city works with entrepreneurial universities in shaping the smart city ecosystem. Grand challenges: companies and universities working for a better society</i> , 75.	<i>Open innovation, participatory ecosystems, smart city ecosystem</i>
Book One (2021)	2. Scuoito V., Farronato N., 2021. <i>Love in the Start-Up era - A journey to discover the power of love on the entrepreneurial path</i> , Rossi Smith Academic Publishing, ISBN 978-0-473-56818-4	<i>Entrepreneurial emotions, start-up, love, couple entrepreneur, entrepreneurial intention</i>
Conference	3. Gibellato, S., Scuoito, V., Farronato, N., & Pironti, M. (2021, November).	<i>Social entrepreneur, circular entrepreneur, sustainable innovations, disruptive innovations</i>

<p>paper two (2021)</p>	<p><i>Sustainable disruptive innovations: grassroots innovations for social and circular entrepreneurs. In 2021 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD) (pp. 1-7). IEEE.</i></p>	
<p>Confer ence paper three (2022)</p>	<p>4. <i>Farronato, N., Spinazzola, M., Scuotto, V., & Pironti, M. (2022). Trans-city data integration platforms: an explorative study on Smart Dublin and Torino City Lab. In Proceedings of the OpenLivingLab Days Conference 2022 (pp. 129-135). European Network of Living Labs.</i></p>	<p><i>living lab, innovation ecosystem, smart city, data integration, open data, internet of things</i></p>
<p>Confer ence paper four (2022)</p>	<p>5. <i>Spinazzola, M., Scuotto, V., Farronato, N., & Pironti, M. (2022, November). Identifying Synergies and Barriers to the Adoption of Disruptive Technologies for Sustainable Societies-An Innovation Ecosystem Perspective. In 2022 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD) (pp. 1-6). IEEE.</i></p>	<p><i>Innovation ecosystem perspective, disruptive technologies, sustainable societies</i></p>

<p>Book Chapter one (2022)</p>	<p>6. Pironti, M., Gibellato, S., Farronato, N., & Veronica, S. (2022). <i>Nuovi modelli strategici sostenibili e circolari per la rigenerazione del patrimonio industriale. Le prospettive del PNRR. In Patrimonio industriale del ventesimo secolo. Fragilità risorse progetto messa in valore. Alla luce del PNRR (Vol. 3, pp. 137-146). Edifir.</i></p>	<p><i>Business strategic models, sustainable business models, circular business models</i></p>
<p>Book Chapter two (2022)</p>	<p>7. Farronato N., (2022), <i>Città e Tecnologie emergenti in Pironti, M. (2022). Intelligenze artificiali e aumentate: Elementi di economia e management. EGEA spa.</i></p>	<p><i>Entrepreneurship, artificial intelligence, start-up-city, emerging technology</i></p>
<p>Book chapter three (2023)</p>	<p>8. Farronato N.; Scuotto V; Marco Pironti; Del Giudice Manlio; David S. Ricketts, 2023. Linking sustainable entrepreneurial ecosystems and governance models in a new European smart city <i>RESEARCH HANDBOOK ON ENTREPRENEURIAL ECOSYSTEMS EDITOR(S): James A</i></p>	<p><i>Sustainable entrepreneurial ecosystems, governance models, European smart cities,</i></p>

	<i>Cunningham; Matthias Menter; Conor O’Kane; Macro Romano.</i>	
Paper one (2022)	9. <i>Farronato, N., Scuotto, V., Pironti, M., & Del Giudice, M. (2022). The Green Frontier of Mobile Applications in Improving Recycling Consumers’ Behavior. IEEE Transactions on Engineering Management. DOI: 10.1109/TEM.2022.3200945</i>	<i>Mobile applications, green behavior, sustainable start –up; recycling, entrepreneurship,</i>
Paper two (2023)	10. <i>Chaudhary, S., Dhir, A., Farronato, N., Nicotra, M., & Pironti, M. (2023). Nexus between entrepreneurial orientation and intellectual capital. Journal of Intellectual Capital, 24(1), 70-114. European Commission retrieved from https://single-market-economy.ec.europa.eu/smes/supporting-entrepreneurship_en on 14.11.223</i>	<i>Entrepreneurial orientation, intellectual capital, knowledge management, organizational learning, intellectual capital and absorptive capacity, entrepreneurship</i>
Paper three (2023)	11. <i>La Sala, A., Iandolo, F., Mohiya, M., Farronato, N., & Caputo, F. (2023). Unfolding Resilience in Digital Platforms From a Microfoundations</i>	<i>Resilience, digital platforms, microfoundation perspective.</i>

	<i>Perspective. IEEE Transactions on Engineering Management. DOI: 10.1109/TEM.2022.3200945</i>	
Paper four (2023)	<i>12. Scuotto, Deniz, Farronato, Alon 2023. A destination's personality as a factor in tourists' environmental knowledge management. Journal of Knowledge Management. forthcoming</i>	<i>environmental knowledge, destination personality, tourist personality, sustainability, knowledge management</i>
Conference paper five (2023)	<i>13. Spinazzola matteo; nicola farronato; veronica scuotto; marco pironti (2023), Entrepreneurial ecosystems' transition to sustainability: exploring the demand for green talents in 20 global cities, Euram Conference 2023 ISBN 978-2-9602195-5-5</i>	<i>Entrepreneurial Ecosystem; Green Talent; Online Job Vacancy; Green Skill; Quadruple Helix</i>

Based on the results of these works, Chapter 5 highlights their linkages and debates the concepts of start-up city in the circular economy era. There are three distinct domains that are considered: entrepreneurship, disruptive technologies, knowledge management. In turn, a new theoretical framework is offered and includes smart cities, entrepreneurial ecosystems; data sharing open source platforms; and circular innovation models. It brings up new original contributions for scholars and practitioners. The first one considers expanding the knowledge domain about smart cities or better say cities for entrepreneurs. Second, it provides a new

model for data sharing across cities and their entrepreneurial ecosystems. Third, it develops evidence and managerial implications thanks to the foundation and participation by the author in 2 start-ups, each developing innovative solutions for the cities of the future. Namely, during the PhD journey, the author have been leading the formation and the developments of two companies, all based in the city of Turin, each covering a specific element of the mobility of the future: PLASY is a smart-road service company and COSMODITY is a space mobility service company.

1.4.1 Research aim

The aim of the present research is to deeply interrogate how smart cities are becoming cities for entrepreneurs (and so start-up cities) in the scenario of the circular economy. It considers different realities like companies, entrepreneurs, consumers, environment; and so on.

1.4.2 Research objectives

To address the research aim, the research objectives of this work are outlined as follows:

ROI: To interrogate the historical evolution of cities – from the initial concept of urbanism to city for entrepreneurs.

RO2: To highlight domain which can be used to interrogate the cities for entrepreneurs

RO3: To formulate the reasoning behind an appropriate analytical framework.

RO4: To critically examine the traditional paradigm of start-up cities and offer a new model for data sharing across cities and their entrepreneurial ecosystems.

RO5: to forge the theoretical framework into a practitioner and managerial implication by starting-up 2 new companies in the smart city real and contributing to 1 company renewing .

1.5 Definitions of Terms

The key terms such phenomena in terms of urban technology or urban tech (Adler & Florida, 2021); urban entrepreneurialism; technopolis; entrepreneurial city (Levenda & Tretter, 2019) and start-up city of the present PhD collection thesis are presented as follows:

Urban Technology	Urban technologies are composed of mobile and space-sharing applications. These technologies involve “the balance of power between citizens, workers and society.” (Adler & Florida, 2021)
Start-up Urbanism	The concept of start-up urbanism defines how people should live like entrepreneurs. A city promotes an entrepreneurial culture

	<p>“comprising knowledge, creativity and a variety of communities of practice, enabling the individual to become an ‘entrepreneur of himself’” (Rossi and Bella, 2017: 1001). This requests a form of urban governance which shifts from a centralized to decentralized approach.</p>
<p>Urban entrepreneurialism</p>	<p>According to Harvey (1989: 8), it rests ‘on a public-private partnership focusing on investment and economic development with the speculative construction of place rather than amelioration of conditions within a particular territory as its immediate (though by no means exclusive) political and economic goal’.</p>
<p>Technopolis</p>	<p>Smilor, Gibson, and Kozmetsky (1989: 50) defined it as “[a city] that interactively links technology commercialization with the public and private sectors to spur economic development and promote technology diversification. Linking technology and economic development in a new type of</p>

	city-state is an emerging worldwide phenomenon.”
Smart City	It is considered a place where human skills and capability, intellectual and social capital along with technologies meet (Caragliu et al. 2011).
Entrepreneurial city	Parkinson and Harding (1995) have described the entrepreneurial city as ‘one where key interest groups in the public, private and voluntary sectors develop a commitment to realizing a broadly consensual vision of urban development, devise appropriate structures for implementing this vision and mobilize both local and non-local resources to pursue it’ (66-67).
Entrepreneurial city	An entrepreneurial city is considered a smart city. There is a bidirectional relationship between entrepreneurship and smart cities. First, entrepreneurs initiate technological interventions that help cities undergo socio-technical transitions and become smart cities. Second, the technologies being adopted in cities generate data which then helps

	enterprises to explore new opportunities. (Kummitha, 2019: 1).
Circular Economy	“A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles.” (Ellen MacArthur Foundation, 2016; in Kirchherr et al., 2017: 772).
Disruptive technologies	“Disruptive technologies can be either a new combination of existing technologies or new technologies whose application to problem areas or new commercialization challenges (e.g., systems or operations) can cause major technology product paradigm shifts or create entirely new ones” (Kostoff et al., 2004 :142).
Entrepreneurship	Entrepreneurship is the process of doing something new and different for the purpose of societal improvement or wealth creation (Kao, 1993).
Ecopreneur	“a person who seeks to transform a sector of the economy towards sustainability by starting

	<p>up a business in that sector with a green design, with green processes and with a life-long commitment to sustainability in everything that is said and done” (Isaak, 2022:82)</p>
Innovation Ventura	<p>“Innovation ventures are AI intensive companies, where AI augments the relationship between humans-humanoids by empowering employees' ability to continuously generate new useful knowledge”. (Del Giudice et al., 2023, p. 6).</p>
Entrepreneurial ecosystems	<p>Entrepreneurial ecosystems is defined as “an interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures” (Cohen, 2006, p. 3).</p>
Greening entrepreneurialism	<p>It is a new trend which characterized those entrepreneurs who are focused on environment, sustainability and so assume a green behavior. This introduces the concept of cleantech and eco- entrepreneurs (Levenda & Tretter, 2019)</p>

Cleantech	It “is distinguished by the pursuit of new market opportunities through innovation” (Caprotti, 2012 in Levenda & Tretter, 2019, p.494).
Eco-entrepreneur	“ Ecopreneurs work on innovations in the green economy, ranging from renewable energy to circular economies to eco-tourism, which holds the promise of more sustainable development, economic growth, and better ecological stewardship” (Schaper, 2016, in Levenda & Tretter, 2019, p. 493)
Intellectual capital	Intellectual capital is an intangible asset made of human capital, structural capital and relation capital (Dabić et al., 2021).
Resilience	“Most of us think of resilience as the ability to bend but not break, bounce back, and perhaps even grow in the face of adverse life experiences. Determinants of resilience include a host of biological, psychological, social and cultural factors that interact with one another to determine how one responds to stressful experiences” Southwick et al., 2014:2).

1.6 My research journey

I have twenty five years' experience as a manager and entrepreneur in the innovation and technology international markets, both with manufacturing sectors experience as well as software.

I have also contributed and delivered a number of enterprise education content over the past 10 years, across a variety of audiences ranging from the public sector, small and medium enterprises, big corporations and, of course, start-up incubation and acceleration programmes. Theoretical and managerial implications of this for this thesis are explained in detail later in this chapter. However, a summary of this journey is provided here.

1.6.1 Author biography

I am a T-shape manager and entrepreneur who likes to build new innovative projects and ventures. I gained extensive experience as an international business developer who has worked in several European cities such as Venice, London, Dublin, Paris and Turin. I have practiced and experienced entrepreneurship thanks to the participation in 7 new start-ups in the period 2010-2023. I have developed creative projects in the digital world and have a natural sense of transforming a mere idea into a fruitful business.

My first start-up has been a social entrepreneurship project named Back2Africa, developed in my hometown in Italy. This project objective was to raise funds for Togo & Benin kids through musical events and merchandising. I reached a team of 80 people and a fundraising target of

approximately Eur 750,000. Then I founded B-sm@rk in Ireland, a high potential tech start-up developing a new online service for sentiment analysis. This company raised approximately Eur 2 million in venture capital and developed some intellectual properties. Following this venture I founded VCNY (Venice Chinese New Year) in Italy, a destination marketing project focusing on Chinese millennial travelers. From 2020, when I started my PhD, I have founded other start-ups as follows: W4 Games in Ireland, a commercial open source software company for the gaming industry; Plasy, an Italian start-up developing services for smart cities, Mentor Italia, a consultancy boutique for start-up fundraising and Cosmodity, a space economy tech company developing solutions for smart cities. Moreover, in the same timeframe, I have contributed to the restructuring of Immodrone, an urban air mobility service provider based in Turin.

I am also Entrepreneur in Residence at Techstars' Turin Cities of the future acceleration programme and I served as head of the innovation team for the City of Turin, acting as innovation manager for Torino City Lab.

My academic studies started with a bachelor's degree in economics and international commerce from Cà Foscari University in Venice (1999) and an executive master in entrepreneurship and international management from Kansas School of Business (2007).

During my career I have got several opportunities to teach as a lecturer and guest speaker in innovation and entrepreneurship, both at university classes, corporate education events, workshops and entrepreneurship laboratories and international events. In particular I have gained solid public speaking and lecturing experience during my research and innovation collaboration

with INTENTAC (International Entrepreneurship Academy) and IVI (Innovation Value Institute).

In Italy I have lectured at the universities of Bergamo, Venice, Padua, Turin, Macerata, Genoa, Rome (Unilink). Internationally he lectured at the universities of Dublin (NUIM) and Paris (ESAM).

My education philosophy is built on my personal experience of entrepreneurship and innovation practitioner and tailored to the class he has in front, aiming at providing a good mix of theoretical and practical frameworks. Since 2010 I have lectured for about 300 hours, both in Italian and English.

Furthermore I have been a guest speaker in many international conferences about innovation, start-up and smart cities, such as: EU Innovation Convention 2011 in Bruxelles; 21Minuti-The human start-up 2015 in Milan; Amadeus Customer Loyalty conference 2015 in Guadalupe; Traveldaily Conference 2016 in Shanghai; ITB China 2017 in Shanghai; TravelTech Conference Russia 2017 in Moscow; Smart City Expo 2019 in Barcelona; and Prague City Data Congress 2020, Tedx Lake Como in 2022, among others.

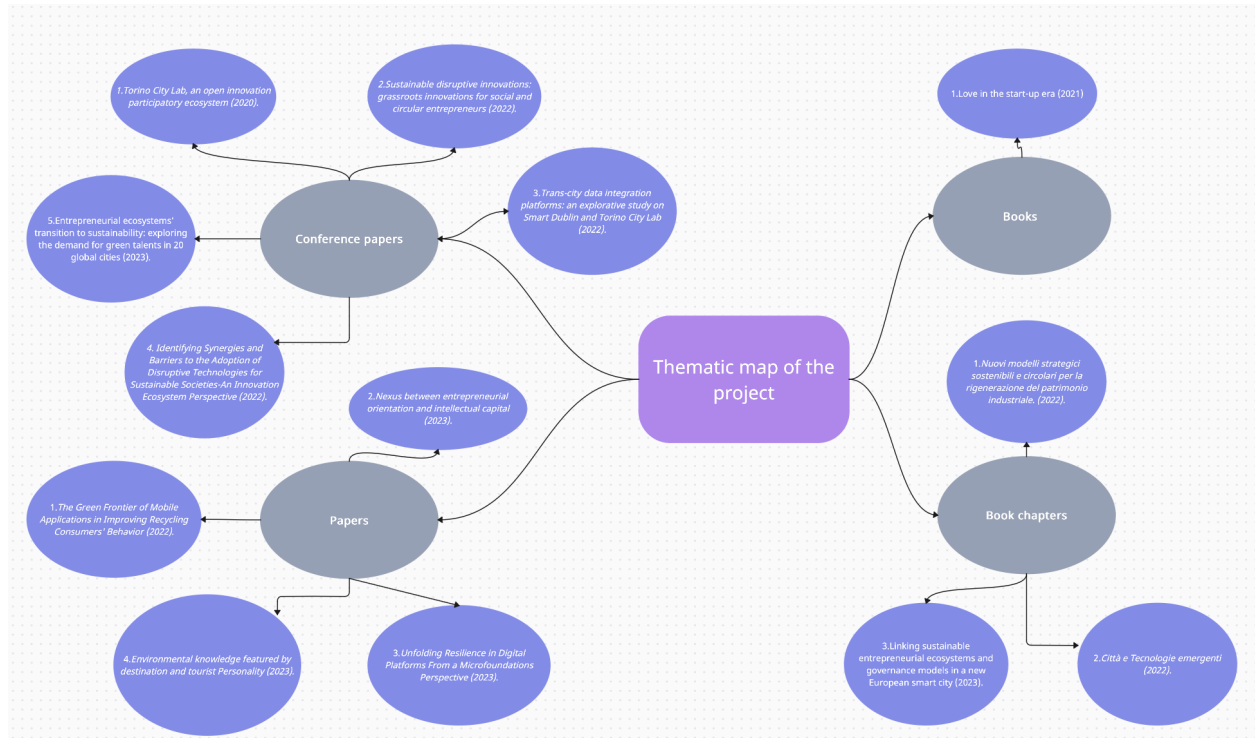
1.6.2 The PhD journey by a collection of papers

The Phd journey is settled by a collection of papers which consists of a range of peer to peer reviewed academic publications which includes 1 book, 3 book chapters, 5 conference papers and 4 journal articles. This route was also validated by Peacock (2017).

In agreement with the Author who *“asserts that the PhD is a credible pathway, having, as with all doctoral routes, both benefits and issues for the candidate, discipline, and institution. She also opines that informed discussions surrounding all routes to doctoral accreditation can lead to more nuanced conceptualisations of the PhD as the pinnacle of academic study”*. (p.130).

This has been challenging the traditional PhD pathway since 1966 when it was introduced at Cambridge University and it is becoming very popular in Academia (Wilson, 2022). This form of PhD pathway is retrospective and relies on already peer reviewed academic works which are published and disseminated (Davies and Rolfe, 2009). However, there is the need to demonstrate a coherence and consistency among all works which define the PhD pathway (Badley, 2009). This route stimulates a collaborative and multidisciplinary research approach. It allows a researcher to share his\her ideas with peers and highly experienced scholars and improve his\her skills and knowledge. Kamler (2008) affirms that *“co-authorship with supervisors is a significant pedagogic practice that can enhance the robustness and know-how of emergent scholars as well as their publication output.”* (p.238). Although multi-authored publications can be considered a limit for validity and consistency, the individual contribution overcomes such issues (Wilson, 2022). A PhD by publications is continually exposed to evaluation and critical analysis which adds an extra value to supervisors and viva panels' judgements (Robins and Kanowski, 2008).

Figure 2: Thematic Map of the Project



Source: Author's elaboration

This PhD by publications is supported by epistemology which offers new contributions to the broad management theory (Khin et al., 2011). Epistemology helps to develop a new theoretical model which is fundamental to explain the new advancements in theory. This work shows how starting, principally, from an inductive approach is possible to provide new epistemological theories. In turn, a new theory originated relying on a circular model which calls for the existing body of knowledge (Neurath, 1944). A research, so, should be replicable and repeatable to present a reliable knowledge. Usually, a researcher should detail the empirical research in order to provide procedures and protocols. Generally, this thesis adopts an inductive approach which starts from specific observations to the general. The Author's professional background has

allowed him to get access to several datasets and/or companies in order to observe the situation first and then explore theories and build up some hypotheses.

Across the thirteen publications a variety of methods were employed: case studies; surveys; semi structured interviews and so on. The choice was based on the most appropriate method to be used for that specific research. Hence, this thesis shows either qualitative or quantitative research that made a variety of contributions for the management community. The central theme is start-up city in the circular economy era which offers different outlooks on companies, citizens and consumers. The linkage of each paper is discussed in chapter 3 where a new conceptual framework is proposed.

1.7 Methodological approach

As aforementioned, there is not a single approach used but both qualitative and quantitative which allows one to understand the multi-methodological approach of the Author. The thematic and chronology map of this thesis (Figure 3) articulates the Author's pathway posed under the frame of a microfoundational and the Quintuple Helix Innovation System.

1.8 The submission

The University of Turin's Regulations for Research Degrees (8.2.2) articulates the pathway to the award of PhD by Research Publication. In particular the Doctoral School organizing the PhD in Innovation for the circular economy requires the publication of a number of significant research papers which are then drawn together into a complete thesis via an extended critical

narrative. Applying this approach, this submission will be made on the basis of a portfolio composed of 13 published works made up of 4 journal articles, 5 conference articles, 1 book and 4 book chapters. All 13 publications are then linked to the common themes of entrepreneurship, technological innovation and knowledge management, through this overarching critical narrative piece. The work was carried out over a period of approximately 3 years and each publication represents a contribution to the field in its own right and combines to provide a structured and coherent body of work. Of the 13 contributing publications, for 1 article the researcher was lead author and for 3 articles the researcher was a co-author. 1 article was published in a 2* journal, 3 articles were published in 1* journals and 1 article; however, all journals are placed in the list Anvur- Fascia A.

1.9 Contribution

This work is a portfolio of practice-based research inspired by the researcher's own observations

thanks to a solid experience at the crossroads of smart cities, technology start-ups and knowledge management. The author's unique point of view on the research problem provides valuable insights in terms of new potential models for cities to avail of start-ups to become faster in the emerging technology adoption. As a manager, entrepreneur, smart city leader and researcher about the cities of the future I believe I can provide valuable insight into the area of study from all possible perspectives. However this thesis and the approaches, models and techniques contained therein also form a blueprint for research-based practice and as such it has resonance and relevance for smart city leaders as well as start-up founders who are concerned

with the development of new start-up friendly cities ecosystems able to raise the competitiveness of the territory. As such this work makes a new contribution to knowledge in particular with regards to the proposed “trans-city data integration platform”, i.e. an open source repository in which cities can share and address opportunities of experimentation, innovation and new start-up creation with their entrepreneurial communities. Moreover this study explores the boundaries of how a city could learn from a start-up the virtue of fast adoption when it comes to emerging technologies. The emerging concept of the start-up city, as described by Florida (2014, 2020), represents a new model for urban planning and talent attraction, beyond city competitiveness.

The 13 peer reviewed works presented here describe a new framework for an effective approach to support the development of the start-up city model in a circular economy era, a moment in which sustainable societies are looking at synergies and barrier removal to avail of disruptive technologies for improving their quality of life. This new approach which is grounded in current research around management and entrepreneurial theories adopts a practice-based approach which is also rooted in industry. Key theories such as the microfoundation and quintuple innovation helix models on the field of start-up, city, entrepreneurship, and circular economy are embedded in the PhD journey and explain the linkages between each work.

1.10 Summary

This first chapter introduces the work of the Author along with his research pathway and professional background. Overall, it anticipates some key contributions based on the thematic and chronological map of the Author’s research journey. It also briefly describes the

epistemology and methodology approach which goes to the validation of the PhD by publications. In this chapter, the Author stresses out the relevance of his central topic “start-up city in the circular economy era” which is linked to the next chapter (Chapter 2) which offers an overview of the theoretical scenario of this theme and its relative subjects.

The Theoretical Background

Chapter Two

2.1 Introduction

As shown, the first chapter discusses the theoretical and chronological map of the Author's journey which is explicated in thirteen original peer to peer reviewed works (from book, conference paper, book chapter to journal article). The duality of methods – qualitative and quantitative – is described along with its general contributions. While, the second chapter offers a general outlook of the theoretical background of the main core topic 'start-up city in the circular economy era' which have mostly characterized the work designed as Conference paper one (2020); Conference paper two (2021); Conference paper three (2022); Conference paper four (2022); Book Chapter one (2022); Book chapter three (2023) which than have induced other works which show the sustainable approach of consumers and companies (paper one and paper four); entrepreneurs consisting in their emotions and orientation (book and paper two) and disruptive technologies resilience by a microfoundation perspective.

2.2 Paradigms of Start-up City

Conference paper one (2020); Conference paper two (2021); Conference paper three (2022); Conference paper four (2022); Book Chapter one (2022); Book chapter three (2023) examine the literature of start-up cities employing an inductive approach. In this line, the evolution of start-up city sits on different concepts which grow from urban technology, urban entrepreneurialism, technopolis, and entrepreneurial city. These variety of concepts evolved in line with the context transformation where a city was a mere supporter for entrepreneurs and a place to develop

disruptive technologies until nowadays it is called to be a place where forges new entrepreneurs. Basically, there is the need not just for economic support but also for a physical one which requests new infrastructures and technologies. In this sense, an entrepreneur is not simply one who exploits new opportunities (Schumpeter, 1934) but also one who does something new and different for the purpose of societal improvement or wealth creation (Kao, 1993). As Audretsch et al. (2015) and Florida and Hathaway (2018) affirm that there is the need of forging new entrepreneurs and developing the culture of entrepreneurship as part of the territorial economic strategies. They talk about urban entrepreneurialism where the connection between public and private institutions are requested. The involvement of different actors design the topic of the entrepreneurial ecosystem which reshapes the environment from a cultural, social and physical view.

Entrepreneurial ecosystems get more accessible intellectual capital in the form of human capital, social capital and structural capital (Dabic et al., 2021), investments, and public and private institutional support, mentorship programs, and public funds. Entrepreneurial Ecosystems are fundamentally based on the entrepreneurial world which goes close to the concept of start-up city which shows high-growth cities of entrepreneurship (Levenda and Tretter, 2019). Cities are considered the hub of knowledge where to spur entrepreneurship (Acs et al., 2017; Audretsch et al., 2015). This happens with the strong presence of incubators, accelerators, regional policy, and research centers. Indeed, a close collaboration between cities, universities and industry is strongly recommended (Malecki, 2018). Carayannis et al. (2022) describe such collaborations in a form of a helix which includes triple, quadruple and quintuple dimensions along with the increasing relevance of green behavior and intangible assets. These actors shape an EE and support the development of new entrepreneurs. In turn, the context of a city assumes the

connotation of being “start-up urbanism” (Rossi & Di Bella, 2017). The concept of start-up urbanism defines how people should live like entrepreneurs. A city promotes an entrepreneurial culture “comprising knowledge, creativity and a variety of communities of practice, enabling the individual to become an ‘entrepreneur of himself’” (Rossi and Di Bella, 2017: 1001). This requests a form of urban governance which shifts from a centralized to decentralized approach. This has changed from living and working, embracing a different approach based on co-living and co-working. In turn, the shared economy has started to populate cities with riders, home-sharing, urban deliveries and so on. These are new innovations which have transformed cities also in a set for technological advancements where entrepreneurs can exploit opportunities (Adler & Florida, 2021). These approaches and related technologies (in terms of new platforms) have introduced the new wave of industry 4.0 which, consequently, has brought up the economy of Society 5.0 (Del Giudice et al., 2022; Del Giudice et al., 2023; Konno & Schillaci, 2021). Scholars distinguish these economies for their focus on technologies the Industry 4.0; instead on human beings the Society 5.0. Actually, cities, or better say start-up cities have started to fully embrace the Society 5.0 approach. The citizen is posed at the center of each decision and co-participate to the decision making process of a city. In one of the Author’s works, he describes the case study of Torino City Lab where actually the citizen is invited to collaborate with the city which is interested in making close partnerships with companies and other public-private actors (Cillo et al., 2021). Additionally, the Author talks about another case which is techstar that has generated more urban tech companies in line with the most innovative start-up cities such as Silicon Valley, Boston, New York, London, Beijing and Paris. As Carayannis et al. (2022) has introduced, cities need a pool of actors which are interconnected. This is also stressed out by Adler & Florida (2021) who identify the factors for such cities in

citizens, economic size and access to a branch of talent and research centers – which include universities.

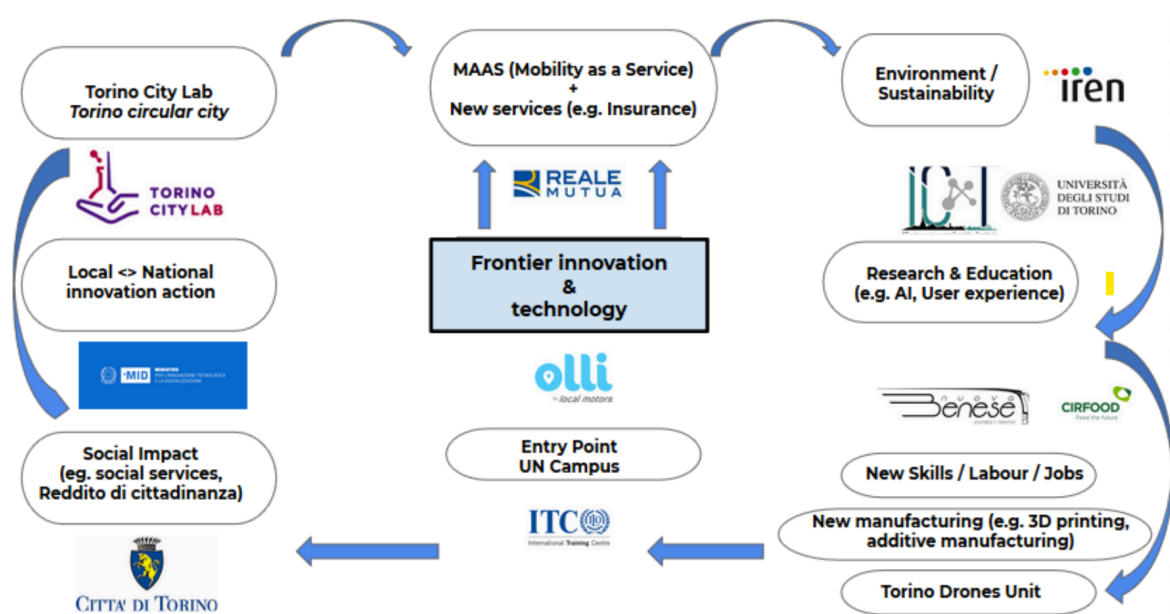
2.3 Moving from a Tech center approach to a human being approach

The city is operating in an economic shift which moves its orientation from technologies to human beings. This change employs a different city model which left behind the urban tech city to advance towards the start-up city where new innovation ventures originated. Innovation venture was introduced by Del Giudice et al. In 2023 to explain the primary role of human beings (e.g. founders, employees, etc) along with the use of new technologies (e.g. artificial intelligence, internet of things, augmented reality, etc) for the success of a company. In a nutshell, innovation ventures are high tech companies where technologies improve the relationship between human- humanoids through employees' empowerment in generating new knowledge. Smart cities have reshaped the interactions between technologies and humans. Caragliu et al. (2011) affirm that the smart city is a place where human skills and capability, intellectual and social capital along with technologies meet. The human –urban relationship is mediated by technologies that previously were simply computers today are framed in the context of more advanced technologies like artificial intelligence and metaverse (Pironti, 2022).

Technologies have sped up this evolution, introducing new innovations. As it is possible to go deep into the Authors' work in chapter 4, he has analyzed innovations in a broad spectrum of sectors spanning from disruptive technologies applied to dangerous driving behaviors in cities, smart roads to connected and autonomous driving for the cities of the future to urban air mobility and space mobility innovations. Some of the entrepreneurs championed these realms in the city

of Turin, in which the author has forged a deep experience as head of the local innovation team. Companies like Skypersonic for instance have contributed to experimentations about confined spaces drone operations during the pandemic; autonomous driving for urban mobility has been a strong focus thanks to international companies like Local Motors (Olli) and Sheeva; local champions of innovation such as Immodrone have been engaged by the city to perform urban air mobility missions about environment monitoring and historical building filming; urban recycling App Junker has been advertised to the local population to accelerate the recycling behavior of the citizens towards a more sustainable society. These urban technologies are produced in cities which are territorially interconnected with all actors. In one of the Authors' work (Cillo et al., 2020), he has introduced the open innovation participatory ecosystem (see figure 2.1) to explain how the involvement of local actors can generate innovations in a more efficient way.

Figure 2.1 Open innovation participatory ecosystem



Source: Cillo et al., 2020

Figure 2.1 above proposes an example of how the metropolitan City of Turin has developed a unique approach to the open innovation participatory ecosystem. The use case is an experimentation at urban scale, involving one international start-up with a deep knowledge into the connected and autonomous driving sector. This company comes from the most important technology ecosystem in the world, Silicon Valley, and in 2021 it has launched an international call for cities of Europe to apply for a free of charge test period of an autonomous vehicle for public transportation. The product was known as Olli, a self driven shuttle able to carry up to 8 people, and move them around using a sophisticated data platform which was updated daily via a cloud IT infrastructure. The City of Turin applied through its smart city arm Turin City Lab and it has been able to win the challenge presenting its Turin Smart Road infrastructure as a very advanced urban experimentation framework for international companies. Once gained this high profile opportunity the innovation team designed a framework named “open innovation participatory ecosystem” aiming to break down the complexity of managing such a technologically challenging project by means of a wide involvement of the city’s innovation partners. The City of Turin, in fact, thanks to the 2020 initiative named Torino City Lab, has been able to create an open innovation ecosystem of companies and organizations of all sizes, willing to help and be involved in the metropolitan innovation projects and experimentation with a light engagement framework. Olli project has thus represented an ideal opportunity to call for a participation in the challenge to the whole ecosystem. Starting from the more institutional stakeholders such as Comune di Torino, Italian Ministry of Innovation and Turin City Lab (left hand side of the figure), the ecosystem has started to gather a critical mass of consensus to run the project and it has been able to involve a UN campus based in the city to act as a test ground (ITC ILO). The nature of the experimental project needed to engage with bespoke actors of the

ecosystem, as well as more generic partners. In the first group Reale Mutua has been able to issue a special insurance policy for mitigating the risks of the project; Iren, the multiutility partner of the city, has been called up for managing the environmental, charging and sustainability aspects; the University of Turin and its cross-disciplinary inter-departmental center ICxT has been involved to perform some risk assessment on the usability and user experience of the service. Further minor contributors belonging to the innovation and entrepreneurial ecosystem of the city have been involved, such as Benese Transport company and CIRFood. This project has run for about 6 months with the aim of raising the profile of the future of mobility in a city which has been moving from car manufacturing to a transition dictated by global new paradigms as far as mobility and transportation are concerned. The experimental nature of this framework has tested well in terms of ecosystem participation and mutual shared benefits in terms of knowledge sharing, managerial implications for companies and public smart city policy.

This conveys three forms of areas which are distinguished in leading tech hubs, large global cities and traditional industrial regions (Popielarz & Neal, 2007). Leading tech hubs are identified in the well known entrepreneurial cities like San Francisco and Boston which are still one of the most influential start-up cities in the world (Start-up Genome report, 2023). They are advantaged from having a pool of big investors which attract several high-tech start-ups. Instead, the strong leverages of large global cities are based on access to higher human capital, entrepreneurial innovation and technologies (Adler et al., 2019; Glaeser & Kerr, 2010). They are also efficient laboratories to produce products and services. This has widely developed industry 4.0 which currently has been replaced by the society 5.0 which centralizes the attention on human capital. Yet, traditional industry regions which resemble the manufacturing industry. As

Adler and Florida (2021) retain “it is possible that traditional industrial regions are more fertile sites for incumbent (i.e., non-start-up) urban tech firms' ' (1798). However, even though cities are becoming so innovative and smart, the environmental and social issues are persisting. Mostly the big cities such as London, Chicago, New York, Milan and even Turin are experiencing the severe problem of pollution and high density of population. This has induced the development of green start-up or green entrepreneurialism which relies on the fact that companies are more concentrated on such issues and to offer solutions.

2.4 Green entrepreneurialism

Levenda and Tretter (2022) talk about green entrepreneurialism which derives from previous research that discusses urban sustainability agenda in relation to urban governance (While et al., 2004). O’Neill and Gibbs (2016) affirm that entrepreneurship and innovation are fundamental for the green economy. Schaper (2016) studies the role of ecopreneur in the green economy scenario, including renewable energy, circular economy and ecotourism. The increasing development of ecopreneurs gives cities a new green identity and brings up new innovations which turn the economy into a cleantech (Horwitch & Mulloth, 2010). As Caprotti (2012) stated, cleantech pursues new opportunities in the market involving ecopreneurs and entrepreneurial ecosystems. The recent relevance of green entrepreneurialism and urbanism has been pushed by the sustainable development goals of the United Nations. This has even more enforced the need of sustainable activities, including circular economy, renewable energy, and social inclusivity. Companies are founded embracing the cleantech model which brings high-tech and sustainable development. For instance, the company BBOXX founded in 2010 in London is a cleantech

company which uses natural resources to figure out the problem of ‘energy poverty’. It provides affordable and clean electricity to remote and global communities. It combines advanced technologies with green services. In one of his works, the Author investigates a recycling company named Junker which combines the evolution of mobile applications with the green education to stimulate more citizens to assume a green behavior toward their own city. Junker is a project offered by a group of ecopreneurs who founded Giunko Srl in Italy. This service is aimed at citizens, industries and public institutions which still remarking the strong relevance of ecosystems in progressing towards green entrepreneurialism and urbanism.

2.5 Entrepreneurialism and Social Innovation

In this scenario it is fundamental to remark the importance of innovation, entrepreneurship and creativity for cities. Schumpeter (1934) reminds us of the first contribution to the concept of innovation which follows the definition of entrepreneur. He distinguishes innovation in incremental and radical, the first is an improvement of existing products\services; while radical innovations bring up disruptive innovations which change the way of living, working and social communication. The Authors talk about those disruptive innovations analyzing grassroots innovation for social and circular entrepreneurs (Gibellato et al., 2021). In this context, Schumpeter considers an entrepreneur who exploits opportunities to put something new in the market.

Thinking of his thoughts, the evolution of these meanings is framed in social innovations. According to the Stanford Social Innovation Review, a social innovation is:

A novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals.

Instead, for the European Commission (2013) “Social innovations are new ideas that meet social needs, create social relationships and form new collaborations. These innovations can be products, services or models addressing unmet needs more effectively.”

In turn, the concept of social innovation remarks the need for sustainability along with the creation of new forms of collaborations (see entrepreneurial ecosystems). This scenario involves cities in attracting and retaining new talents. The whole ecosystem, including the city, is reinventing continuously – as Schumpeter said innovation and entrepreneurship burst this evolution from long cycles. Differently, Marx affirmed that innovation is a cyclic evolutionary process. Considering the recent time which has been strongly impacted by the pandemic event, named COVID 19, it may be possible to appraise Marx’s thoughts. However, Schumpeter in 1939 started to contemplate the cyclic process of such evolution. ‘The problem that is usually visualized is how capitalism administers existing structures, whereas the relevant problem is how it creates and destroys them’ (Schumpeter, 1954, pp. 1734–1735). Jacobs (1969) maintains that economic diversity promotes innovation and city growth. Further, cities are examined as ‘nursery cities’ that point out the role of the city in incubating innovations (Duranton and Puga, 2001) where “universities are also a vibrant source of young, smart workers with frontier skill sets” Kerr & Robert-Nicoud, 2020; p. 67). Universities and research centers produce new talents which the city retains and englobes in its ecosystem. Baumol et al. (2007) individuate four factors which determine entrepreneurial success, that are: 1. “high returns, low start-up costs, disincentives for rent-seeking and competitive pressures on winning entrepreneurs.” (in Florida et al., 2017, p. 90)

which are also accompanied by other factors that influence entrepreneurial performance such as entrepreneurial history, academic institutions, regulatory climate, and economic rewards (also see Iskandar et al., 2022).

The cities put together talents and creativity which are incubated and potentially transformed in companies. The cities are the place that englobes all these factors and mixes together to generate innovations. These innovations are not simply novel products and/or services but they are solutions to societal problems which are generated by interconnecting different actors within the ecosystem. The focus is on the fact that cities are not just a container of enterprises but a place which enables entrepreneurship, or contextually green entrepreneurship.

2.6 Summary

Overall, the second chapter seeks to explain and discuss the theoretical background of start-up city which involves its evolution from urban tech and entrepreneurialism, entrepreneurial city to start-up city along with a greater focus on sustainability which calls for green entrepreneurialism, cleantech, and green urbanism. Cities are not just the place to host entrepreneurs but they become areas to enable entrepreneurship, forging new talents and enhancing entrepreneurial ecosystems with new forms of collaborations and social innovations. In turn, the theoretical background is accompanied with a new theoretical framework that will be discussed in the next chapter.

The Theoretical Framework

Chapter Three

3.1 Introduction

In chapter two, the debate was focused on the theoretical background, bringing up new concepts from urban entrepreneurialism, urban tech, start-up city to green entrepreneurialism, cleantech, ecopreneurs, and green urbanism. The present chapter presents the theoretical frameworks which are behind this PhD by paper collections. The theoretical frameworks are explained and discussed against the main domain: start-up city, entrepreneurial ecosystem, entrepreneurship, circular economy.

3.2 Microfoundation frameworks

The Author has decided to employ a combination of microfoundation and helix trilogy frameworks. This choice is motivated by the fact that microfoundations does not show only the individual perspective but includes organizational context along with interactions among people (Whetten et al., 2009; Barney & Felin, 2013). The concept of microfoundation is well distinguished by a micro analysis which offers primarily an individual lens. The research on microfoundation approach has gained the interest of scholars for decades (Scuotto et al., 2021; Foss, 2009; Felin & Foss, 2005; Gavetti, 2005; Lippman & Rumelt, 2003; Teece, 2007).

The use of this framework has led to a different range of research, consisting in evaluating the influence of individual level on organizations; the impact of individuals' interactions on organizational performance and the relationship between macro and micro variables (Abell et al., 2008). For instance, Felin et al. (2012) state that “microfoundations as a ... theoretical explanation, supported by empirical examination, of a phenomenon located at analytical level N at time t (Nt). In the simplest sense, a baseline micro-foundation for level Nt lies at level N_{21} at time t_{21} , where the time dimension reflects a temporal ordering of relationships with phenomena at level N_{21} predating phenomena at level N . Constituent actors, processes, and/or structures, at level $N_{21}t_{21}$ may interact, or operate alone, to influence phenomena at level Nt . Moreover, actors, processes, and/or structures at level $N_{21}t_{21}$ also may moderate or mediate influences of phenomena located at level Nt or at higher levels (e.g. $N+1t+1$ to $N+n t+n$).” (p. 1355). The authors do not associate actors to individuals. As for Teece (2007), he adopts this framework to analyze dynamic capabilities of an organization “which undergird enterprise-level sensing, seizing, and reconfiguring of capacities that are difficult to develop and deploy” (p. 1319).

Another aspect to be considered is that microfoundation denies the impact of macro factors such as norms, ecosystems, culture and so on have on the organizational environment (Hodgson, 2012; Winter, 2013).

The author of the present work has also adopted microfoundation in one of his works entitled “Unfolding Resilience in Digital Platforms From a Microfoundations Perspective”. The article debates the concept of microfoundation as a lens of the whole research. As aforementioned, the first debate on this approach was based on its form of individualism and collectivism (Udehn, 2002; Felin et al., 2015; Foss & Linder, 2019). The relevance is stressed out on the fact that

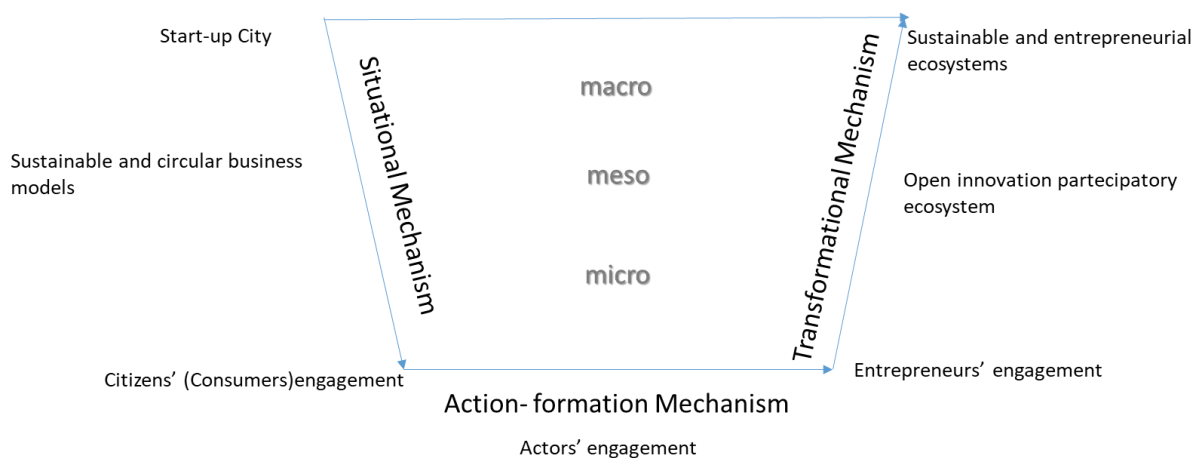
social facts “must be studied as things”. Whereas, “individual nature is only the undefined material that the social factor shapes and transforms” (in La Sala et al., 2023 p.2). The emphasis on collectivism is also remarked by Simmel (1971) and Weber (1949) who believe that individual preferences and interests are fundamental to build up social structure. This form of individualism is useful to understand a collective phenomenon which takes place as an output of social interaction. In turn, a wide range of disciplines have started adopting the microfoundational framework from the social science, organizational theory, economic anthropology to the strategy ones (referring to the economic anthropology, a reading suggested is Hodgson & Knudsen, (2010). Darwin's conjecture: The search for general principles of social and economic evolution). By looking at past research, it is possible to offer an overview of the definition of microfoundations. Nickerson and Zenger (2008) defines it as a method to explain organizational events which are investigated by individual action and interaction which employ the cognition and affect sphere.

Eisenhardt et al., (2010), this framework points out both individual and group level actions that configure strategies, organizations, and dynamic capabilities. Lewin et al., (2011) stress out the involvement of routines and practices for individuals and groups. Lindenberg and Foss (2011) pointed out the methodological individualism. Mollick (2012) affirmed that the microfoundational framework relies on “the part that individual firm members play in explaining the variance among firms” (p.1001). Grigoriou and Rothaermel (2014) talk about the embeddedness of individual action in organizational events. In the same line, Rogan and Mors (2014) retain that organizational events can be decreased by individual actions. Helfat and Petraf (2015) highlight managers’ cognition which influence organizational performance. The microfoundation framework lets managers understand conceptual organizational phenomena

like dynamic capabilities, routines, social capital and so on that are connected with organizational level performance (Storbacka et al., 2016). Such framework allows to “unpack collective concepts to understand how individual-level factors impact organizations, how the interaction of individuals leads to emergent, collective and organization-level outcomes and performance, and how relations between macro variables are mediated by micro actions and interactions” (Felin et al., 2015, p. 4). In a nutshell, to understand the macro events, there is the need to be cognizant of individual and social interactions. In this sense, the microfoundation lens drives the comprehension of “the effectiveness of dynamic capabilities for innovation (Schilke et al., 2018 in Magistretti et al., 2022, p.648). Referring to Coleman’s (1990) work which explains this framework using the metaphor of a boat or a bathtub. He delves into the differences between macro – macro level description where social events conduct social goals and micro- micro level clarification where circumstances for actions drive recognizable activities. Basically, the bathtub allows one to understand either the macro-micro level or the micro – macro level. The first starts from social occasions which clarify action; whereas the second clarifies manifest activities that explain social outcomes. Additionally, there are three mechanisms which consist of the first macro-micro mechanisms which explain how macro conditions impact actors. This is recognised as situational mechanisms. The second is the micro- micro mechanisms which describe how social conditions are integrated into actions. This is known as ‘action –formation mechanisms’. And then the micro-macro mechanisms which are called transformational mechanisms elucidate how social interactions provoke macro level outcomes (Hedström and Swedberg, 1998; Storbacka et al., 2016). According to Jepperson and Meyer (2011) and Dopfer et al. (2004), the situational and transformational mechanisms are elucidated on a meso level. In a nutshell, the microfoundation framework

recognises that socio-economic events consist in a range of different layers which emerge individual, collective, group, organizational and interorganizational areas (Aguinis & Molina-Azorín, 2015). As Felin et al (2015) affirm “social or relational macro constructs such as networks may simply be epiphenomena.” (p.583). Hence, the microfoundational framework relies on different layers of analysis that explore social actors from their relationships which could then explain a macro phenomenon. In this regard, the microfoundational framework is used to explain the PhD collection journey. As figure 1 shows, the macro level is characterized by the social phenomenon of start-up cities and sustainable and entrepreneurial ecosystems. The second layer, that is the meso level, consists in sustainable and circular business models and open innovation participatory ecosystems. Both of them regard the organizational environment. The last layer concerns the micro level which is made of citizens and entrepreneurs’ engagement.

Figure 1. Adaptation of the Microfoundational Framework to the PhD works.



Source: Author’s elaboration

3.3 A nexus of microfoundation and helix trilogy frameworks

To explain the macro layers in the circular economy era, using simply the microfoundation lens was not enough. Therefore, the author has also examined the Quintuple Helix Innovation System by Carayannis et al. (2022). This system offers a helix trilogy which includes triple, quintuple and quintuple helix to individuate stakeholders in ecosystems. In turn, the quintuple helix innovation system relies on knowledge which is explicated in research (or knowledge production) and innovation (or knowledge application), also including ‘sociology ecology’ (p.2280). This perspective includes civil society which is formed by inventors, innovators and entrepreneurs. The new relevant factor of the Quintuple Helix Innovation System is that it regards ‘the natural environment of society’ (‘natural environments of society’).” (Carayannis & Campbell, 2010, p. 62). It describes the new ecologically sensitive transition that delves into the new circular economy approach.

This shows a continuous interplay between research and practices which has designed the development of the Authors’ works.

Figure 2 summarizes the whole Ph.D perspective, considering a microfoundational and the Quintuple Helix Innovation System. The author deeply analyzes his individual contribution on each work in chapter 4.

Overall, Conference paper one (2020) based on open innovation, participatory ecosystems, smart city ecosystem offers a macro perspective and it relies on two concepts of start-up city and open innovation participatory ecosystems which calls for the situational and the transformational mechanism.

Book One (2021) focused on entrepreneurial emotions, start-up, love, couple entrepreneur, entrepreneurial intention which relies on the term of entrepreneurs' engagement looking into his/her emotional side. It is placed at an action –formation mechanism.

Conference paper two (2021) delves into the themes of social entrepreneur, circular entrepreneur, sustainable innovations, disruptive innovations, Torino city lab. This presents sustainable and circular business models which are placed at the transformational mechanism.

Conference paper three (2022) investigates trans-city data, platforms, smart cities, smart Dublin, Torino City Lab which regards the situational mechanism of Sustainable and entrepreneurial ecosystems domain.

Conference paper four (2022) explores innovation ecosystem perspective, disruptive technologies, sustainable societies. In line with the previous one, it considers the situational mechanism of the Sustainable and entrepreneurial ecosystems domain.

Conference paper five (2023) studies entrepreneurial Ecosystem; Green Talent; Online Job Vacancy; Green Skill; Quadruple Helix. This article is interesting because it includes the situational mechanism of the Sustainable and entrepreneurial ecosystems domain which is also connected with the Quintuple Helix Innovation System by Carayannis et al. (2022).

Book Chapter one (2022) inquiries into business strategic models, sustainable business models, circular business models. This article takes in consideration the transformational mechanism in the topic of sustainable and circular business models.

Book Chapter two (2022) looks into entrepreneurship, artificial intelligence, City, and new technologies. This study offers a new overview on the use of the artificial intelligence in the AI

which combines the action-formation mechanism and the transformational one, engaging the themes of entrepreneurs' engagement and sustainable and circular business models.

Book chapter three (2023) looks at sustainable entrepreneurial ecosystems, governance models, European smart cities. It embraces the theme of sustainable and entrepreneurial ecosystems which is connected with the situational mechanism.

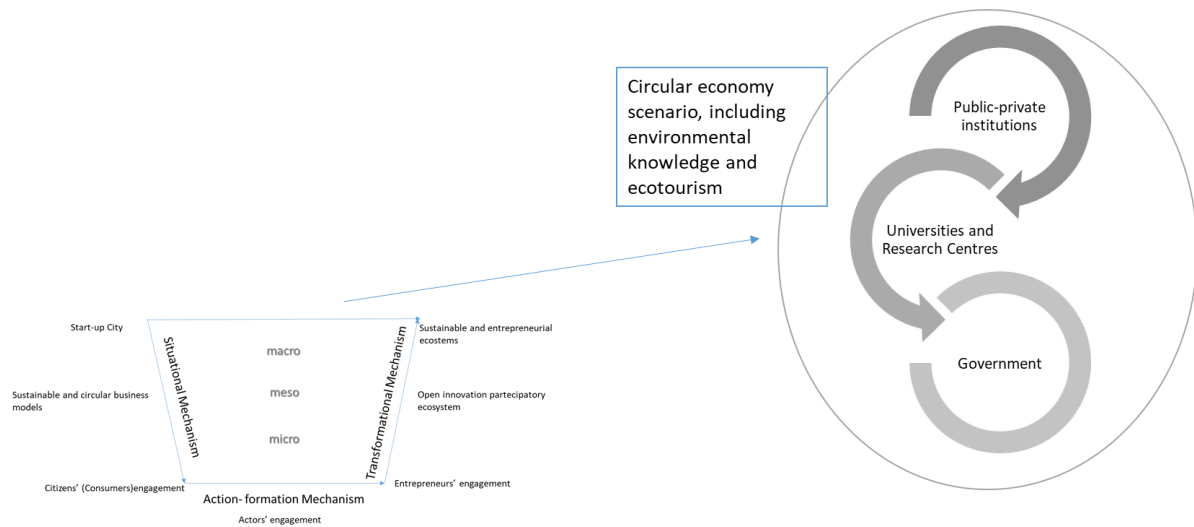
Paper one (2022) examines mobile applications, green behavior, sustainable start –up; recycling, entrepreneurship. If on one side, it relies on citizens' engagement, on the other side, it regards entrepreneurs' engagement referring in both cases to the action-formation mechanism. Additionally, this mechanism calls for the macro concept of green economy and more specifically circular economy (alluding to the Quintuple Helix Innovation System by Carayannis et al. 2022).

Paper two (2023) pores over entrepreneurial orientation, intellectual capital, knowledge management, organizational learning, intellectual capital and absorptive capacity, entrepreneurship, offering the action-formation mechanism perspective in line with entrepreneurs' engagement topic.

Paper three (2023) evaluates resilience and digital platforms, engaging the whole microfoundation perspective.

Conference paper six (2023) research entrepreneurial ecosystems; transition to sustainability; green talents; global cities. This is the last work which summarizes figure 2, considering the involvement of actors such as public-private institutions; universities and research centers and governments, moving towards the new trend of research based on green talents and global cities.

Figure 2. A nexus of Microfoundations and the Quintuple Helix Innovation System.



Source: Authors' elaboration

3.4 Summary

This chapter illustrates the theoretical frameworks of microfoundational and Quintuple Helix Innovation System to explain the logic behind the whole Ph.D collection. A deep discussion is offered in chapter 4 and 6 which respectively, in chapter 4 the whole thirteen works are described; instead in chapter 6 these works are discussed, offering new theoretical and managerial implications which then lead to conclusions of the thesis.

Articulation of the research journey

Chapter Four

4.1 Introduction

The chapter 4 offers a description of the thirteen works developed and published during the three year Phd journey. It goes deep each work showing the Author's contribution and the linkage between each other. This chapter is the core of the entire work because it shows the Authors' effort and knowledge in developing his research identity which shapes the big theme of Start-up city in the circular economy era.

4.2 Conference paper one (2020)

Title

CILLO, V., FARRONATO, N., SCUOTTO, V., PIRONTI, M., PISANO, P., & DEL GIUDICE, MANLIO (2020). Torino City Lab, an open innovation participatory ecosystem. The city works with entrepreneurial universities in shaping the smart city ecosystem. *Grand challenges: companies and universities working for a better society*, 75.

Key themes

Open innovation, participatory ecosystems, smart city ecosystem

Insights and key outcomes

This research is the first work of the Author who is starting to explore the concept of start – up city on a situational mechanism lens which is also associated with the transformational mechanism that includes an open innovation participatory system. It adopts a holistic case study of Turin City lab which relies on the professional duties of the Author working as Head of the Innovation Team of the City of Turin in the period 2019-2021.

This work already commences to englobe the Quintuple Helix Innovation System, exploring the role of universities, research centers, public and private partnership and government which impact entrepreneurs' engagement and influence start-up city performance. Yet, it also

considers citizens ‘engagement which become knowledge producers, offering new innovations to enhance ‘the natural environment of society’ (‘natural environments of society’).” (Carayannis & Campbell, 2010, p. 62).

The present study starts to illustrate the evolution of the city in being smart and more technologically advanced. It also provides an overview of a city which is getting closer to citizens and vice versa. The article introduces the concept of an open innovation participatory ecosystems which:

1. “leads to better and closer services to citizens’ needs;
2. addresses disengagement from politics and democracy, strengthening the sense of trust;
3. increases intellectual capital and community cohesion, and strengthens individual relationships.” (Cillo et al., 2020; p. 78).

This scenario drives the proposition one based on:

P1. A greater increment of Smart cities like laboratorial cities, more involve an open innovation participatory ecosystem approach

Another contribution comes from the discussion on the entrepreneurial culture which could move from a situational mechanism to a transformational one thanks to the collaborations with the universities. In this regards, universities are called for advancing in “a) Leadership and governance; b) Organizational capacity, people and incentives; c) Entrepreneurship development in teaching and learning in order to stimulate and support the development of entrepreneurial mindsets and skills; d) Pathways for entrepreneurs to ensure entrepreneurs are adequately prepared for creating start-ups through their education; f) University - business/external relationships for knowledge exchange with industry, society and the public sector; g) Entrepreneurial University as an internationalized institution; h) Measuring the impact of the Entrepreneurial University monitoring and evaluating entrepreneurial teaching and learning across the institution as well as the impact of start-up support” (p.80).

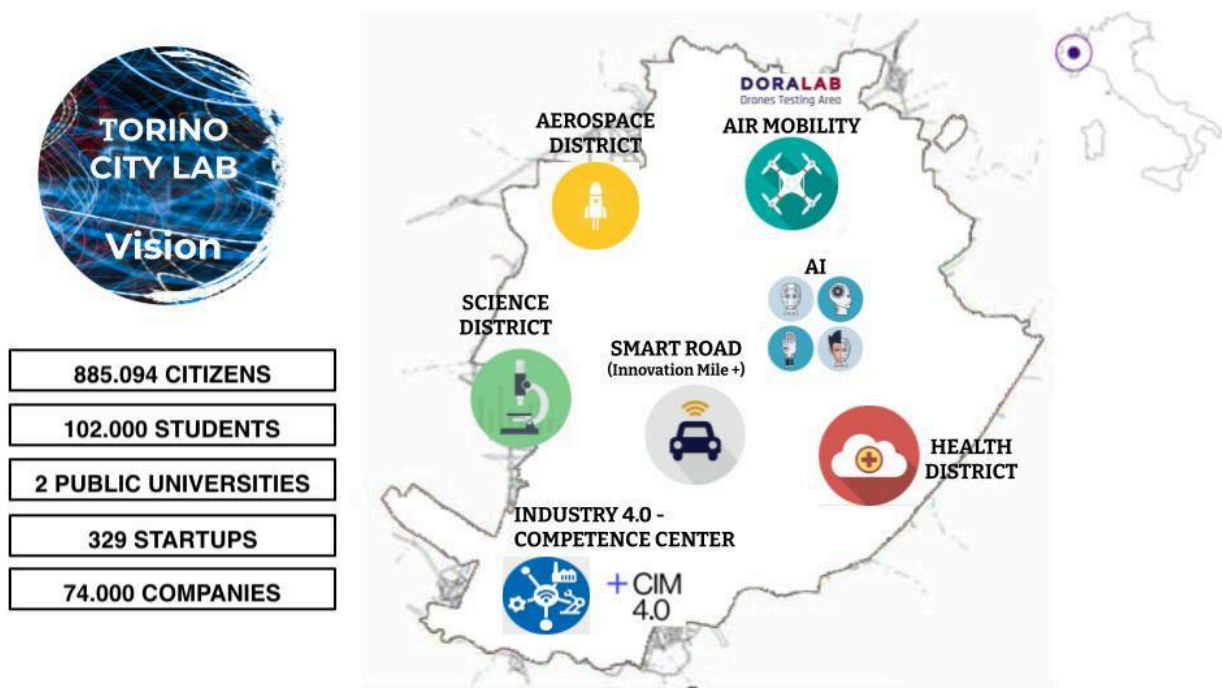
Meanwhile, this consideration triggers the proposition two:

P2. Improving user innovation tools and system thinking approach will result in better public services

Both propositions are analyzed by a case study approach which describes a special project developed by Turin city, which is known as Turin City Lab (TCL). TCL is a peculiar case which adopts an open innovation participatory ecosystem approach. Figure 1 illustrates this

approach characterized by six dots which each of them represents innovation areas: 1. Industry 4.0 competence center, 2. aerospace district, 3. Health district, 4. Science district, 5. Drones testing area; 6. Innovation mile.

Figure 1. Smart towns in Turin



Source: Authors' elaboration

These innovation areas are distinguished by the entrepreneurial culture which is forged by local universities. The approach is novel and diverse from the other cities and shows a close public-private partnership. Figure 2 shows the open innovation participatory ecosystem approach which relies on Carayannis & Campbell (2010). It shows how the approach has been applied in real cases. TCL highlights the relevance of social impacts that cities are undertaking to offer a better life to their citizens. The project has brought up new considerations which enforce the concept of entrepreneurial culture which is disseminated from universities to the rest of the city. Despite that, even the city becomes the place where the entrepreneurial culture is integrated through the new public – private relationships. In turn, innovations are co-created which generate a co-creation value. If Chesbrough involves customers, this approach also includes citizens which operate like entrepreneurs or intrapreneurs of their city.

Figure 2. Example of open innovation participatory ecosystem approach



Source: Torino City Lab archive.

4.3 Book one (2021)

Title

Scuotto V., Farronato N., 2021. Love in the Start-Up era - A journey to discover the power of love on the entrepreneurial path, Rossi Smith Academic Publishing, ISBN 978-0-473-56818-4

Key themes

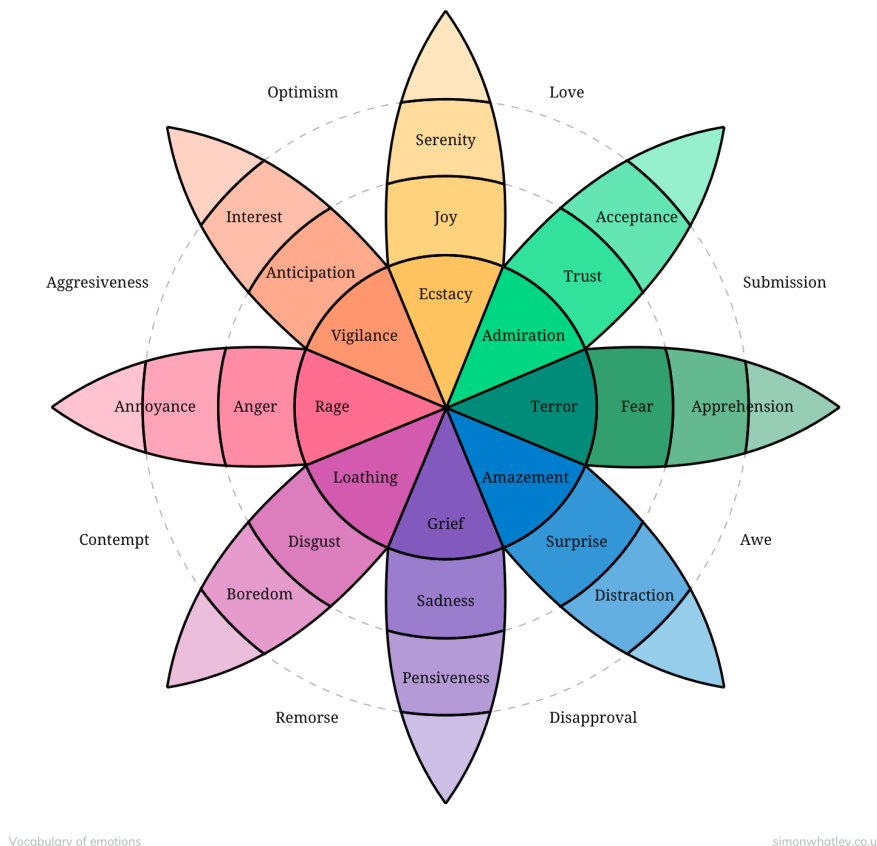
Entrepreneurial emotions, start-up, love, couple entrepreneur, entrepreneurial intention

Insights and key outcomes

The book was developed to explain how an entrepreneurial journey is influenced by emotions which call for personal relationships. This work relies on the base of the microfoundation framework, consisting in action –formation mechanism and entrepreneurs’ engagement.

If the macro context makes a huge impact on entrepreneurs’ pathways, little is known about the combination of their personal and professional scenario. Some studies consider this scenario like family businesses (Kammerlander, 2022; Rovelli et al., 2022; Pearce et al., 2023; Labaki & Hirigoyen, 2020). The book does not engage with the family business literature but it offers a great theoretical and practical contribution to entrepreneurship, innovation and management literature. From the whole rose of emotions by Plutchik (2001) (figure 1), the book is focused on love to highlight the peculiar importance that the human side of a business is getting in this modern age.

Figure 1. Plutchik’s wheel of emotion.



Source: Plutchik, 2001, p. 349

Darin Bifani comments this as “When we consider the human side of business, we see that the journey of many companies does not follow the dotted lines of what is found in business books or fit neatly into the square, fixed boundaries of balance sheets and cash flow statements: love takes entrepreneurs beyond the limits of financial and economic logic, picks them up and carries them to that place where ideas are turned into action. While this place cannot be found on any map, it is there that the real magic of business is often found. In this place the rules of finance and economics can be bent, broken and at times completely reinvented. I think that one of the messages of the Love in the Age of Digital Transformation is that place is everywhere.” (p.x).

Love is not just for personal relationships, it considers the connections with employees, clients and business partners. It can make a bridge between people and strengthen their relationship. The common expression of “we love our job” is emblematic of the key insights and messages of this book which is aimed at those who have interest in entrepreneurship. The work discusses the power of love on a business lens through different case studies which are represented in figure 2.

Figure 2. Case study and their locations

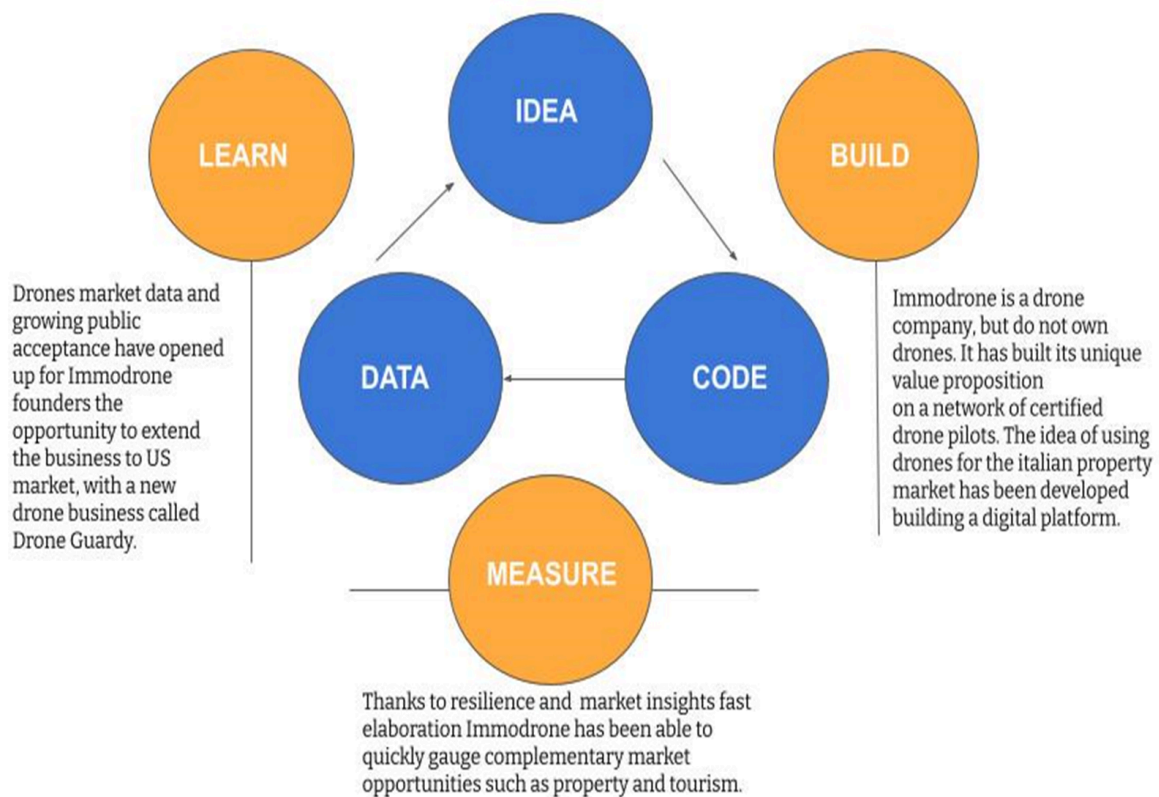


Source: Authors’ elaboration

The book emphasizes the importance of dual –career couples. This concept is an evolution of the classic term co-preneur (Barnett and Barnett, 1988) and calls for a dynamic system of love and work (Marshack, 1994; p. 49). The meaning of the dual career couple is explored by several entrepreneurial ideas formed in the context of Internet-based platforms (gig-economy) and artificial intelligence-based technologies (industry 4.0). Nicola, the author, is also the entrepreneur of one of the business cases. He shows his pains and challenges but also how love has allowed him to get to the transformational mechanism stage and implement his idea of open innovation participatory ecosystem approach. The entrepreneurial journey of Skypersonic and Mamme in sol have described how love is the central driver of their careers. They highlight the importance of family's support and comprehension in a business pathway. In turn, they have been able to shift their passions in a real business which has spread out such love through their service\products. Another key case comes from the entrepreneurial pathway of Team Creatif which emphasizes the role of a woman in taking the business beyond the border. The female entrepreneur of this story is a clear example of L.O.W.E., an acronym that stands for a leader, owner, wife entrepreneur. Her business journey shows several challenges that have been overcome through the love of her business partner (also husband), family and job. However, Love is not just expressed in love between partners and family but also between brother and sister which together can develop a new company. This is the case of Immodrone. Finally, there is Elefanteveg which shows the relevance of making a social impact on people's lives. They combine physical and digital spaces to convert individuals' habits into a new one based on respecting the planet and their body. The case of Elefanteveg presents the love for nature, the environment and human beings.

All these stories are rich in insights and inspiring for all people. They offer an astonishing trajectory of dual career people – either they develop the business together or not- and the big impact that their love for business can have on the planet and people. Each case is also explained by some practical activities which allow the reader to experiment and test their entrepreneurial skills and capabilities. For example, a lean startup model (Ries, 2011) to explain their evolution and growth (Figure 3).








Figure 3. Immodrone Lean startup model



Source: Scuotto & Farronato, 2021

Another activity was associated with Elefanteveg, that is the SCAMPER method which means Substitute; Combine; Adapt; Modify; Put to another use; Eliminate; and Reverse, in addition to Love (Figure 4).

Figure 4. Elefanteveg SCAMPER

-  **Substitute**
How could we find a creative alternative to food blogs, leveraging on our founders talents?
-  **Combine**
Which are the skills we could combine to generate innovation in our vision?
-  **Adapt**
To which emerging lifestyle could we adapt the new concept of food blog?
-  **Modify**
What can we modify from a traditional food blog to make it unique?
-  **Put to another use**
Can we focus on food ingredients and put them to another use in order to be innovative?
-  **Eliminate**
What category of food products can we eliminate from our blog?
-  **Reverse**
How can we succeed in reversing the communication of the key message of a food blog?

Source: Authors' elaboration

4.4 Conference paper two

Title

Gibellato, S., Scuotto, V., Farronato, N., & Pironti, M. (2021, November). Sustainable disruptive innovations: grassroots innovations for social and circular entrepreneurs. In *2021 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD)* (pp. 1-7). IEEE.

Key themes

Social entrepreneur, circular entrepreneur, sustainable innovations, disruptive innovations, Torino city lab

Insights and key outcomes

This study also considers the action-formation mechanism and the entrepreneur's engagement. Additionally, it explores the green economy scenario, examining a form of sustainable disruptive innovations known as grassroot innovations (GIs). A case study analysis was conducted. A food community from Italy, known as "Gruppo di Acquisto Solidale" was analyzed. Interestingly enough, it has emerged that GIs are considered as disruptive innovations which make a social, environmental and economic impact on the whole society. Additionally, the paper discusses also the role of eco-entrepreneur which have been introducing a new business model, relying on the United Nations' principles (see 17 sustainable development goals"

Considering theoretical and managerial implications, the paper supports the study of Christensen et al.,

(2006) which highlights that innovation to be disruptive and catalytic should consist of: "1 Through scaling-up and replication, they bring systemic societal transformation; 2 They fill a need in the market that is either overserved or completely unsatisfied; 3. They provide goods and services that are either easier to use and less expensive than the alternatives. 4. They generate resources in undesired ways, such as volunteering, intellectual assets, contributions, or donations as opposed to mainstream actors; 5 They are frequently rejected, disparaged, or even supported by established players who refuse or withdraw from the market sector because the

business strategy is unprofitable or otherwise unappealing.” (Gibellato et al., 2021). The human side of a business is highly emphasized, remembering that technologies empower human beings; whereas human beings are the core of a business in terms of generating new innovations and promoting them. The cognitive side of GIs emerged as a combination of social motivation and eco-entrepreneurs’ attitude (Tortia et al., 2020). Another interesting perspective is the social benefits for the community – one of those is community based solutions which can overcome the big problem of resource scarcity by collaborations and resource sharing.

Concluding, on one side the article relies on action-formation mechanism and the entrepreneur’s engagement, and on the other side, it refers to citizens ‘engagement which become knowledge producers, offering new innovations to enhance ‘the natural environment of society’ (‘natural environments of society’)’ (Carayannis & Campbell, 2010, p. 62). As the Authors state: “this work extends the sustainable development literature showing an innovation based on ethical principles linked to environmental protection. Indeed, inside GAS the active citizenship has direct control of product consumption. People can purchase food goods directly from producers buying at kilometer 0. It reduces wastes produced along the food supply chain (Brunetti & Giaretta, 2007).”

4.5 Conference paper three (2022)

Title

Farronato, N., Spinazzola, M., Scuotto, V., & Pironti, M. (2022). Trans-city data integration platforms: an explorative study on Smart Dublin and Torino City Lab. In *Proceedings of the OpenLivingLab Days Conference 2022* (pp. 129-135). European Network of Living Labs.

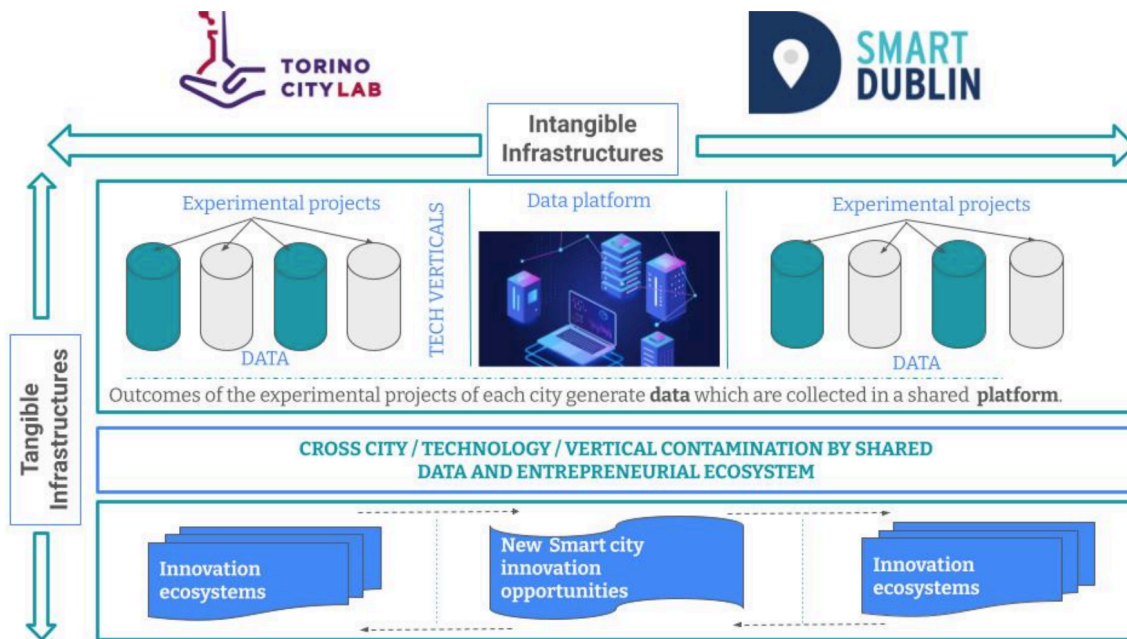
Key themes

living lab, innovation ecosystem, smart city, data integration, open data, internet of things

Insights and key outcomes

In this work, the author moves to a different perspective which goes from a meso to a macro scenario involving the situational and the transformational mechanism. The study offers a new trans-city data integration platform (figure 1) on the smart city programs, comparing two smart cities, Turing and Dublin. It refers to the open innovation participatory ecosystem argued in the previous work and enhances it, introducing the key role of big data. In turn, it is based on living labs and innovation ecosystems. Additionally, the paper also offers a new factor to the work of Carayannis and Campbell (2010), that is the big data. Getting all partners together requests “massive amounts of data from a multiplicity of local stakeholders” (129). The power of data is explored in the sense of “aggregating and integrating data from multiple cities via a common infrastructure”.

Figure 1. A trans-city data integration platform



Source: Farronato et al., 2022, p.134

The empirical evidence based on 53 projects launched between 2020 and 2021, revealed a common interest for large-scope District/ City solutions, Mobility, and People, and also Environment and Culture. Again, it supports the great interest and attention the cities are paying

for social impacts. The key point of this study is the theoretical framework of a trans-city data integration platform which shows the cross fertilization and contamination for cities through data and entrepreneurial ecosystems. It is supported by tangible and intangible infrastructures that shift innovation ecosystems in new smart cities innovation opportunities and vice versa. Data is the central driver of the whole evolution which facilitates the shift from the meso to the macro scenario, considering the circular economy scenario.

4.6 Conference paper four (2022)

Title

Spinazzola, M., Scuotto, V., Farronato, N., & Pironti, M. (2022, November). Identifying Synergies and Barriers to the Adoption of Disruptive Technologies for Sustainable Societies-An Innovation Ecosystem Perspective. In *2022 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD)* (pp. 1-6). IEEE.

Key themes

disruptive technology, technology adoption, sustainable technology, ecosystem mapping, innovation ecosystem, LinkedIn

Insights and key outcomes

Considering the transformational mechanism based on sustainable and entrepreneurial ecosystems and also including the ecosystem perspective of Carayannis and Campbell, 2010, the present conference paper offers an empirical analysis on the adoption of disruptive technologies for the transition to more sustainable societies by mapping businesses' uptake in the Italian region of Piedmont. The data collection has occurred by the social media platform LinkedIn which has allowed textual information on over 17,000 organizations across a variety of industries (a number of 115 sectors), placed in the Piedmont region (table 1).

Table 1. Dataset Summary

Sector	Business size				
	Total	<10 empl.	11-50 empl.	51-200 empl.	>200 empl.
Information Technology and Services	1189	574	351	155	109
Marketing and Advertising	843	622	170	42	9
Automotive	714	156	252	185	121
Mechanical Or Industrial Engineering	661	162	319	127	53
Machinery	631	119	295	162	55

Management Consulting	582	402	141	26	13
Construction	562	211	238	94	19
Food & Beverages	428	193	153	61	21
Industrial Automation	382	137	170	52	23
Architecture & Planning	336	268	59	8	1
Computer Software	326	158	118	31	19
Design	325	229	67	18	11
Professional Training & Coaching	307	207	78	13	9
Renewables & Environment	288	165	92	21	10
Apparel & Fashion	260	144	66	24	26
Furniture	254	124	95	24	11
Internet	252	185	52	12	3
Leisure, Travel & Tourism	226	151	51	17	7
Electrical/Electronic Manufacturing	225	62	99	36	28
Textiles	221	47	97	59	18
Events Services	210	157	42	8	3
Business Supplies and Equipment	206	86	93	20	7
Financial Services	206	93	58	36	19
Health, Wellness and Fitness	206	131	50	17	8
Food Production	204	32	125	34	13
Other Sectors	7589	3650	2358	922	659
Total	17633	8465	5689	2204	1275

Source: Authors' elaboration

Alongside, a text mining method was employed to understand the level of engagement of those organizations with innovative technologies such as 5G Networks, Advanced Robotics, Artificial Intelligence, Autonomous Drive, Blockchain, and Drones. The results show interesting trends which are valuable for both scholars and practitioners. In details, 7.1% of all organizations have adopted at least one technology. Then majority of them were located in the metropolitan city of Turin and were bigger (in terms of size) than others. As the Authors affirm: “Moreover, engagement appeared to increase with the organization’s size, as this value raised from 5.7% for organizations with less than 10 employees, to 6.9% for those with 11 to 50 employees, to 8.5% for those with 51 to 200 employees, and up to 9.8% for those organizations with 200 employees or more.” (Spinazzola et al., 2022, p.3). The differences in using those technologies are also evident from sector to sector as follows: “Industrial Automation (9.3% of all organizations in this sector adopted at least one technology), Information Technologies and Services (4.3%), Aviation and Aerospace (3.5%), Computer Software (3.5%), Electrical/Electrical Manufacturing (3.0%), Telecommunications (2.3%), Mechanical or Industrial Engineering (2.1%), Machinery (1.7%), Insurance (1.5%), Internet (1.5%), Automotive (1.4%), Renewables and Environment (1.2%)”. More specifically, “the most commonly uptaken one was Advanced Robotics, counting 543 organizations (equivalent to 3.1% of all organizations) across 69 sectors and primarily in Industrial Automation, Mechanical or Industrial Engineering, Machinery, Information Technologies and Services, and Automotive; followed Artificial Intelligence, with 479 businesses (2.7%) across 92 industries and mainly in Information Technologies and Services, Computer Software, and Automotive; 5G Networks, with 221 companies (1.3%) across 42 sectors and predominantly in Information Technologies and Services and Telecommunications; Drones, with 84 organizations (0.5%) across 41 industries and mostly in Aviation and Aerospace; Blockchain, with 74 businesses (0.4%) across 23 sectors and predominantly in Information Technologies and Services; and last Autonomous Drive, with 19 companies (0.1%) across 8 sectors but mostly in Automotive.”

Overall, as noted, organizations placed in town are more prone to use those new advanced technologies. This may stem from the new infrastructures that a town can offer. Although, there still are some challenges to overcome to disseminate massively the use of technologies. One of those challenges regards resources’ scarcity which can be addressed by a synergic collaboration with different ecosystem actors such as government, universities, research centers, smart cities

etc. which should lead cities towards sustainable and smart societies. Such a synergic approach can also be helpful to develop an exchange of knowledge among the different ecosystems which can support each other and promote the use of those technologies to be more sustainable and smart.

4.7 Book Chapter one (2022)

Title

Pironti, M., Gibellato, S., Farronato, N., & Veronica, S. (2022). Nuovi modelli strategici sostenibili e circolari per la rigenerazione del patrimonio industriale. Le prospettive del PNRR. In Patrimonio industriale del ventesimo secolo. Fragilità risorse progetto messa in valore. Alla luce del PNRR (Vol. 3, pp. 137-146). Edifir.

Key themes

Business strategic models, sustainable business models, circular business models

Insights and key outcomes

This work is particularly interesting because it involves a multidisciplinary approach, including architecture and design. In this work, the Authors discuss the relationship between public and private organizations which generate strategically new innovations. In this case, it is possible to observe all steps of the general framework based on microfoundation and the Quintuple Helix Innovation System. Moving from a macro level which involves the engagement with ecosystem actors to a meso level which promotes an open participatory ecosystem approach to end with a micro level which includes citizens and entrepreneurs. Universities and companies become more innovative and prone to be part of the blue ocean. The study offers a case study approach, focused on one of the best projects developed by Turin City, that is Turin City Lab. Turin is recognised to be one of the most innovative and smart cities in Italy and even in Europe. It has adopted an open innovation approach which is also represented by Turin City Lab. Turin City Lab is a city laboratory where citizens are involved in the process of generating innovations. In turn, this project has engaged with the whole territorial ecosystem, including public and private institutions. It has shown a solid and strong collaborative approach to engage with the local

ecosystem and even with the international one. Turin City Lab was launched in 2017 which has engaged with the whole territory in less than a year. This project is structured like *open innovation participatory ecosystem* which is characterized by:

- o An online platform known as www.torinocitylab.it, released in English and Italian versions.
- o Multi-stakeholders' engagement which includes public and private institutions, companies, venture capitals, business angels, and so on;
- o A competitive program defined as "*Call for Challenge*" which seeks to encourage the citizens to propose new solutions for urban challenges and so improve their quality of life;
- o A support to develop the idea and to experience it thanks to the public and private assistance;
- o Access to all key stakeholders to evaluate the feasibility, viability and desirability of the idea.

Furthermore, during the COVID 19, the need to help the community and make a social and environmental impact became more pervasive. In this sense, Turin City Lab was accompanied with a new project known as Turin City Love, consisting in a sustainable and circular business model and aimed at disadvantaged people. For example, offering new laptops, internet access, new learning programs to those who could not afford it (like students at the high school). Microsoft has offered a school version of Office 365 for free and friendly to use. The project 'Skype in the classroom' has allowed the delivery of new learning programs and city and museum tours for students. Fastweb has guaranteed to 500 students a free internet access in order to help them to participate in the online classes. These projects were developed with the support of the whole ecosystem and with the scope of:

The focus was on human beings and their needs to help not just the most reactive and proactive people but also the most disadvantaged people (e.g. poor and old people) to remove the digital gap and the educational one.

4.8 Book Chapter two

Title

Farronato N., (2022), Città e Tecnologie emergenti in Pironti, M. (2022). Intelligenze artificiali e aumentate: Elementi di economia e management. EGEA spa.

Key themes

Entrepreneurship, artificial intelligence, start-up-city, emerging technology

Insights and key outcomes

The present book chapter offers a meso and macro perspective, involving the concept of “open innovation participatory ecosystem” along with sustainable and entrepreneurial ecosystems. Yet, this also includes the quintuple innovation ecosystem model to describe the new approach of start-up cities and emerging technologies.

New disruptive technologies are hitting the society in a constant flow, hence researchers are trying to develop some maps of the most significant disruptive technologies that will have the bigger impact for cities and their citizens in the coming 30 years (Watson, 2018). The adoption of new emerging technologies such as the internet of DNA, space elevators, cosmic shelters and so on is expected to be faster, for end users, than when the telephone was introduced in the market. In fact while telecommunication technologies took about 30 years to achieve a 50% average adoption rate (data based on US families), most recent innovations like social media, tablets and smart devices took 10% of time to achieve the double in adoption rate. Therefore, if end users are evolving fast, cities are not that much. Usually, cities take more than ten years to fully embrace the use of such technologies in their organizational system. In turn, there is the need to offer new solutions which can transform the cities in:

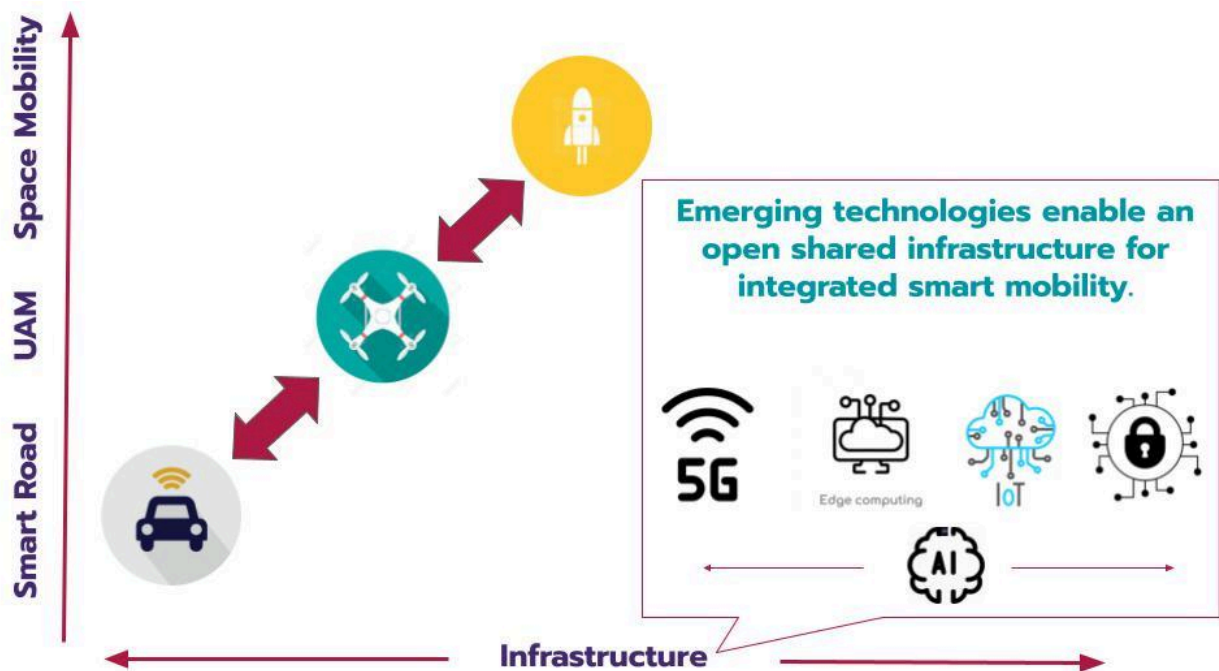
- urban laboratories which become a place to experiment new technologies, involving and engaging with citizens, companies, universities, etc.
- start-up cities assume the role of entrepreneurial hub to spur the flourishing of new business ideas by the use of new technologies.

In this scenario, cities need to be accompanied with innovation ecosystems which can support and facilitate their evolution from smart city to smarting city which defines the increasing

advancements requested along with their implementation, thanks to the support of the whole innovation ecosystem.

Figure 1 below shows the smart mobility holistic framework that the innovation team of Turin City Lab developed aiming to foster the open innovation culture across the city’s ecosystem of actors interested in this innovation vertical.

Figure 1. Smart mobility holistic framework



Source: Farronato, 2022 in

Figure 1 simplified representation of the City of Turin framework for the holistic smart mobility strategy of the city. The model intends to highlight how economies of scope can be generated by means of developing shared common infrastructures between smart road, urban air mobility and space mobility, thus unfolding the role of enabling technologies at different levels of urban mobility.

Turin has been the first city in Italy to pre-authorize a 35 kilometers urban circuit for testing connected and autonomous vehicles. This decision has opened up many opportunities for the

innovation and entrepreneurial community in terms of attracting key players of this emerging market to test their latest innovation in the Piedmont capital. Example of the impact of this strategic decision range from the victory of the Olli project, as described in chapter 2, and in the creation of a group of companies called the “Smart Road group” which have been engaging with the most important international association of players in the autonomous driving scene, 5GAA. The Turin’s smart road circuit has attracted infrastructural investment by big corporations like Cisco, Intel, TIM, among others with the aim of equipping the test ground of the vehicles of the future with state-of-the-art technologies (i.e. edge computing, advanced sensors, smart lighting, etc.). The holistic smart mobility framework, moreover, has grown to include infrastructures for communication between vehicles and drones, like for example in car accident prevention use cases. In such scenarios, drones could communicate thanks to 5G technologies with vehicles with a very low latency, and inform them about warnings and obstacles ahead. Thanks to the collaboration with the European Space Agency (ESA), satellite data and communication have also been considered with the aim of enhancing the precision and the predictability of potentially dangerous traffic and road conditions. In the context of a holistic smart mobility strategy, the benefits to the innovation and entrepreneurial ecosystem of the city have been tangible, mainly in terms of de-risking some innovation processes and receiving the endorsement of a metropolitan city in knowledge sharing and dissemination initiatives. It is relevant to add that high impact groups of technologies such as artificial intelligence, which have been deployed into this framework since the inception, have brought state investments from the Italian Ministry of Innovation for the creation of an AI competence center on smart mobility in Turin.

4.9 Book chapter three (2023)

Title

Farronato N.; Scuotto V; Marco Pironti; Del Giudice Manlio; David S. Ricketts, 2023. Linking sustainable entrepreneurial ecosystems and governance models in a new European smart city
RESEARCH HANDBOOK ON ENTREPRENEURIAL ECOSYSTEMS EDITOR(S): James A Cunningham; Matthias Menter; Conor O’Kane; Macro Romano.

Key Themes

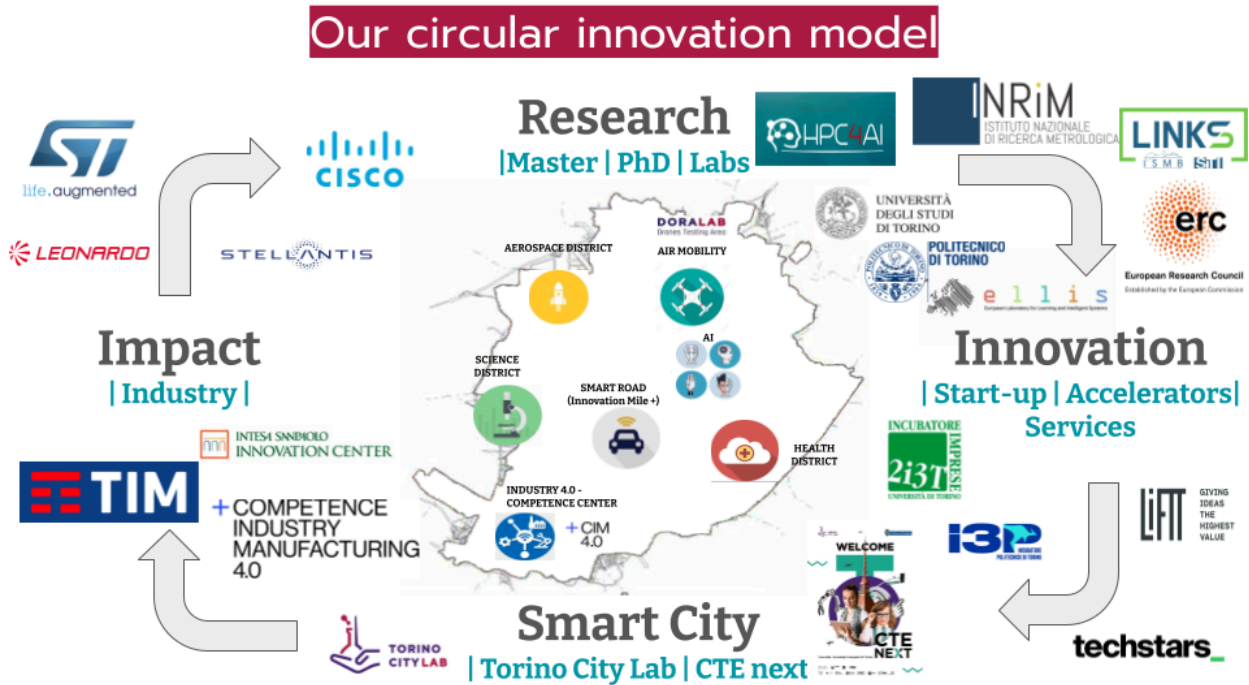
Sustainable entrepreneurial ecosystems, governance models, European smart cities,

Insights and Key Outcomes

This academic outcome comes from a PhD visiting at the Technology and Entrepreneurship Center at Harvard University (Cambridge USA) along with my supervisor Professor Pironti. In that period, I was lucky enough to meet Professor Ricketts who has a strong expertise on innovation, entrepreneurial ecosystem and entrepreneurship. The present book chapter delves into studies on entrepreneurial *ecosystems (EEs) and governance models to analyze the advancing scenario of smart cities. The work argues the shift of EEs from being unsustainable to being sustainable which calls for the process of recycling and regenerating resources. It takes in consideration the open innovation participatory ecosystem model to understand how the relationships between public and private organizations can stimulate new experimental projects. As for some of the previous studies, the book chapter includes the whole framework stems from the PhD paper collection journey. It considers from a macro level a macro level which involves the engagement with ecosystem actors to a meso level which encourages an open participatory ecosystem approach to end with a micro level which includes citizens and entrepreneurs. There are also some influences from the Quintuple Helix Innovation System to explain the entrepreneurial ecosystem and the relationships between public and private organizations along with social goals. A case study analysis is employed to investigate an European smart city ecosystem model of EEs which involves the experimental project of Turin, id est Turin City lab and a new recent project known as CTE (Casa delle Tecnologie Emergenti). Respectively, “As stated by the city of Turin annual report (2020), in the last two years TCL approach has been appreciated in Italy and in Europe by implementing more than 50 urban and sustainable experimentations, involving almost 100 private and public organizations and launching 5 challenges for new venture creation. The most relevant fields of innovation have been as follows: smart roads, urban air mobility, Internet of Things, Artificial Intelligence, 5G communication technologies and Big Data. Remarking the sustainability side of the TCL model, it is worth mentioning the valuable project developed during the worldwide pandemic event, id est COVID 19. This project named Turin City Love has called for the strong collaboration of the EE local network which was able to release more than 100 sustainable*

initiatives to support the territory thanks to the use of new emerging technologies.” Farronato et al., 2023) (figure 1).

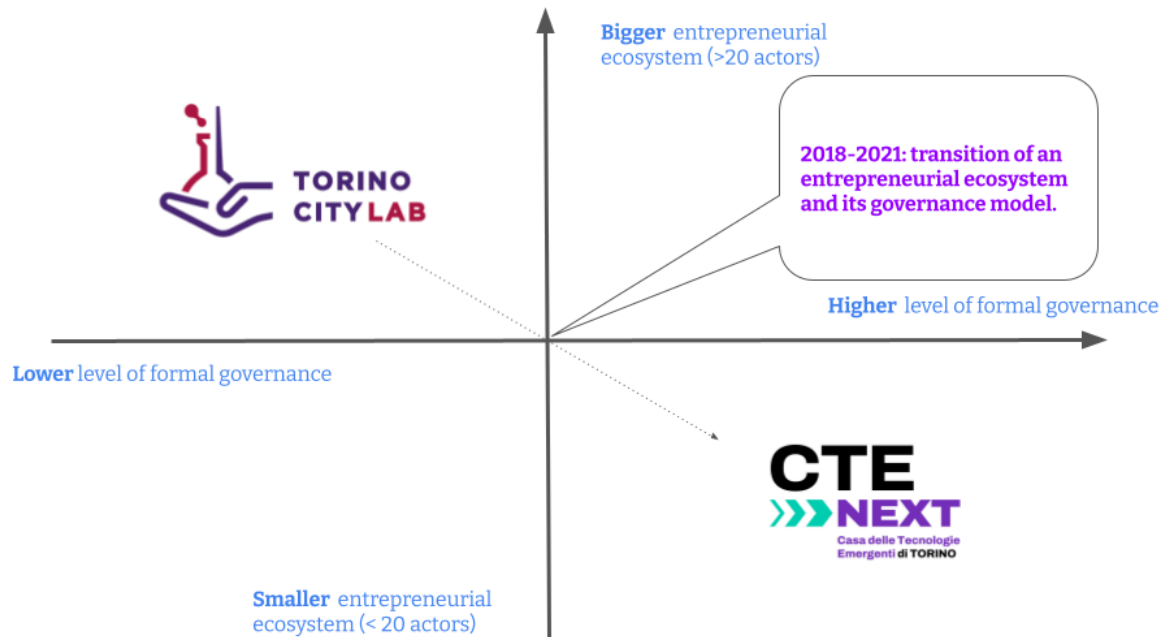
Figure 1. Turin’s smart city circular innovation model



Source: Torino City Lab archive

CTE was approved by the Italian Ministry for Economic development with the scope of developing a new European smart city EE model. Figure 2 shows how this model is defined which intertwines a governance model (formal and informal) with the EEs size. For instance, CTE “is designed around a smaller network of core partners and is defined by a higher level of formal governance than TCL ones even though the City of Turin is still keeping its leadership role.” (Farronato et al. 2023).

Figure 2. CTE project model



Source: Authors' elaboration

Overall, the study offers two different governance models. The first one is described by the Turin City Lab project which is more flexible, less formalized and with a wider network. Instead, CTE represents the European smart city EE model which is more formalized, so less flexible and with a range of selected partners. EEs become not just a space for developing new ventures but also a place to knowledge exchange and transfer (Cantner et al., 2021) between a diverse range of partners such as universities, research centers, government, among others (Audretsch et al., 2019; Audretsch & Beliski, 2017; Stam & Spigel, 2016) which can rely and/or challenge a governance model (Cuningham et al. 2019). The study also highlights the relevance of the bottom up approach that defines the two governance models (Farronato et al., 2020) and includes the human - centered city framework (Gudowsky et al. 2017). In this sense, innovations are democratic and generated by citizens who are active actors in the process of

generating new business ideas. Citizens are proactive in promoting new social solutions for their well-being and the territory itself (Albino et al., 2015; Von Hippel, 2009).

From a managerial perspective, there are three key implications. The first one relies on the connection and coordination among all actors which demands a big effort from the leader (who is a city as in this study). As noticed, the city has a role of harmonization of the EEs and monitors all experimental projects. The second implications consider the self-regulation of an EE and its mechanisms to manage stakeholders' goals and roles. The involvement of an open innovation participatory ecosystem model is necessary to get the state of harmony and collaboration among partners. Finally, the third implication regards the governance model which can be a guide to administrate EEs, its city project, and also achieve the goal of being more sustainable.

4.10 Paper one (2022)

Title

Farronato, N., Scuotto, V., Pironti, M., & Del Giudice, M. (2022). The Green Frontier of Mobile Applications in Improving Recycling Consumers' Behavior. IEEE Transactions on Engineering Management. DOI: 10.1109/TEM.2022.3200945

Key Themes

Mobile applications, green behavior, sustainable start –up; recycling, entrepreneurship,

Insights and Key Outcomes

In this work, the Author offers a business perspective looking into green technologies through mobile app users' environmental engagement. The growth of users of mobile applications has stimulated companies to teach them how to be more sustainable.

During the COVID 19, the users' behavior has been changed, becoming environmentally conscious and aware of plastic pollution. Combining the increasing use of mobile applications and this new green attitude has promoted the research in investigating by the lens of consumer social media engagement behavior (CSMEB), it has emerged that media richness has a positive

correlation with user engagement and recycling behavior on a sample of 12 539 users in Italy. “Italy is considered a suitable setting for this research because of the introduction of new sustainable policies which encourage responsible consumption and production in line with the sustainable development goals of the United Nations. The Italian government has thus been pushing green consumer behavior. In more detail, the work uses Partial Least Square-Path Modelling (PLS-PM) to investigate the capacity of mobile applications to engage with consumers through their content and interactions – grouped within the concept of media richness – and to influence their behavior in favor of recycling. This methodology performs well with a limited pool of theoretical developments (Hair et al., 2017).” (Farronato et al. 2022; p.1).

The data were collected through a mobile app known as Junker. Junker aims to engage with users to stimulate sustainable behavior towards their environment and society. Junker relies on the 17 Sustainable Development Goals and the Circular Economy Package released in 2015 and has just recently received the Ecohitech Award 2021 in Italy. This mobile application educates users how to recycle and renovate goods. Junker is an intermediary between government and citizens to teach how to be more sustainable. “Since its launch in 2016, the Junker app has engaged with more than 1.3 million people in 800 municipalities, and it lists 1.6 million goods in its database. The app will refer to the guidelines of a user’s city and show the user how to properly dispose of any product included in its database. It also allows users to suggest new products and indicate flaws in the listed information. In response to its many features and services, the app has registered 40 million visits and 30 million barcode scanners per day. The richness of this app relies on images, texts, barcodes, quizzes, and blogs.” (Farronato et al., 2022; p. 9).

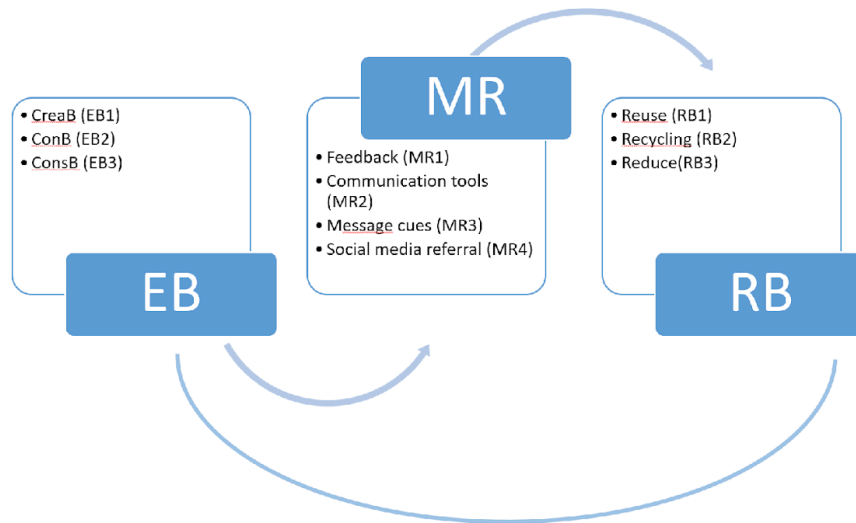
The research design (figure 1) is defined regarding the following variables :

“Engagement behavior is composed of creation behavior (EB1), contribution behavior (EB2), and consumption behavior (EB3; Cao et al., 2021; Schivinski et al., 2016). It is an independent variable that is assessed in relation to MR and RB.

Media richness is a mix of different types of content which can facilitate cognitive, emotional, and social bonding. This occurs through ‘feedback (MR1), communication tools (MR2), and message cues (MR3)’ (Cao et al., 2021, p. 839; Brunelle, 2009) along with social media referral

(MR4). This variable assumes the position of dependent or independent variable; in other words, it is exogenous.”

Figure 1. Research design



Source: Authors' Elaboration

From this research design, three hypotheses are formulated as follows:

1. HP1 – *the higher the level of engagement behavior, the greater the media richness*
2. HP2 – *the more favorable the media richness, the greater the likelihood that a user will recycle*
3. HP3 – *the higher the engagement behavior, the greater the likelihood that a user will recycle.*

For a better understanding, the full empirical analysis as follows:

“4.2 PLS-SEM analysis

The empirical analysis developed by PLS-SEM is structured in two stages. The first one is the measurement model to assess the reliability of the research design. The second stage is the structural model used to test the hypotheses.

4.2.1 Measurement model testing

According to previous studies, the measurement model is useful in estimating the validity and reliability of the research design (So et al., 2020; Shi et al., 2017). The reliability was calculated by Cronbach's Alpha (CA) to assess the internal consistency between measures and items. If CA exceeds 0.5, the measurement model can be accepted. Convergent validity was calculated by the average variance extracted (AVE) and the factor loading (FL) which also should exceed the value of 0.5 (Hulland, 1999; Hair, Holt et al., 2016) as shown in Table 1.

Table 1. Cronbach's Alpha (CA) test

Measures	Items	FL	CA	AVE
EB	EB 1	0.834	0.594	0.523
	EB 2	0.754		
	EB 3	0.900		
MR	MR 1	0.824	0.623	0.682
	MR 2	0.721		
	MR 3	0.639		
RB	RB 1	0.651	0.583	0.643
	RB 2	0.837		
	RB 3	0.921		

4.2 Structural model testing

The structural model testing allows the estimation of the positive correlation between the three measures EB, MR, and RB. Before calculating the correlations, it is necessary to assess the collinearity between those measures/variables to avoid any issue in the evaluation of the path coefficient. In this case, the variance inflation factor (VIF) was calculated, offering a value less than 3 (Table 2; Si et al., 2020; Hair, Ringle & Sarstedt, 2012).

Table 2. Collinearity results

Measures/variables	VIF
EB	1.380
MR	1.420
RB	1.509

To test the hypotheses, a path analysis was conducted which demonstrated a positive correlation among all variables. As shown in Table 3, EB has a positive impact on MR, and MR has a positive impact on RB that is also positively affected by EB.” (Farronato et al., 2022; p. 11-13).

Table 3. Path Analysis

Hypotheses	Path	T-Value	Path Coefficient	Hypotheses supported
Hp.1	EB –MR	4.6	0.0000	Yes
Hp.2	EB-RB	6.2	0.0000	Yes
Hp.3	MR – RB	7.1	0.0000	Yes

These results support the three hypotheses. Considering HP1 – *the higher the level of engagement behavior; the greater the media richness – highlight the active role of users in engaging with media which offers rich services and stimulate them in new interactions.*

affirms the active role of users in the consumption journey. As Aity et al. (2018) affirm media richness creates new stimuli that improve the level of users' engagement. In turn, mobile applications are the space for online shopping and the venue for new teaching approaches (Li et al., 2012; Boyinbode et al., 2017; Selamet & Simpson, 2019). While HP2 – *the more favorable the media richness, the greater the likelihood that a user will recycle*– emphasizes the green attitude and awareness of users in adopting green behavior. This drives to a linkage between engagement and recycling behavior that is positive, which moves to HP3 – *the higher the engagement behavior, the greater the likelihood that a user will recycle*. This hypothesis calls for the three principles of the circular economy which are reduce, reuse, and recycle (3R; Khan et al., 2019, Agamuthu & Fauziah, 2011). Overall, the article induces the dissemination of social and moral norms to promote pro-environmental behavior (Miliute-Plepiene et al., 2016; Byrne & O'Regan, 2014) and green consumption (Ramayah et al., 2010). In turn, it offers new best practices to rid of inequality and environmental disasters to trigger companies to be more sustainable and a better workplace.

4.11 Paper two (2023)

Title

Chaudhary, S., Dhir, A., Farronato, N., Nicotra, M., & Pironti, M. (2023). Nexus between entrepreneurial orientation and intellectual capital. *Journal of Intellectual Capital*, 24(1), 70-114.

Key themes

Entrepreneurial orientation, intellectual capital, knowledge management, organizational learning, intellectual capital and absorptive capacity, entrepreneurship

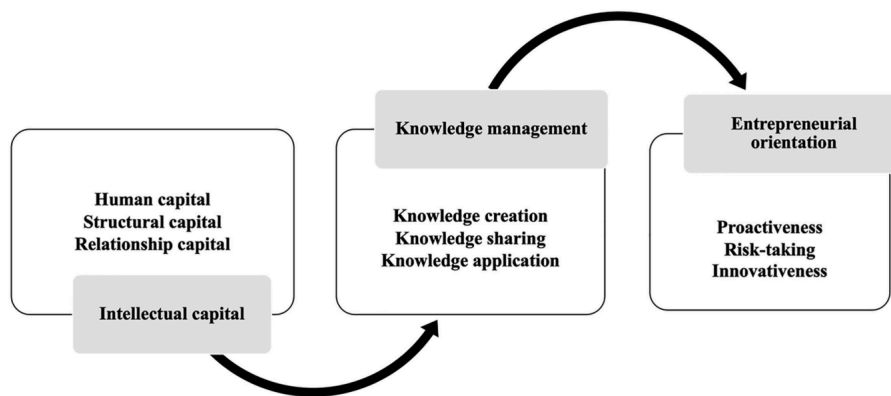
Insights and key outcomes

The present article is framed in the action –formation mechanism of the microfoundation perspective. It is primarily focused on entrepreneurs' engagement offering a systematic literature review on entrepreneurial orientation and intellectual capital. As emerged, the knowledge based assets and capabilities are relevant for entrepreneurial orientation. Yet, in this

realm it is revealed that knowledge management, organizational learning, intellectual capital and absorptive capacity play a key role in entrepreneurship.

The authors propose a theoretical model to explain how intellectual capital and its management influence firm-level entrepreneurial behavior. They noticed that there is the need for a deep understanding of the linkages between “intellectual capital, the ability to manage knowledge (namely, creation, conversion, sharing, dissemination and application) and entrepreneurial orientation”. Such linkages are presented in a research design which shows the key aspects of the three pillars. Intellectual capital is formed by structural capital, human capital, and relationship capital; knowledge management is composed of knowledge creation, knowledge sharing, and knowledge application; and entrepreneurial orientation is made of proactiveness, risk-taking, and innovativeness (figure 1) which are explored and discussed through previous studies in order to address the following research questions:

Figure 1. Research design



RQ1. What are the predominant thematic areas of research on the intersection of intellectual capital, the capability to leverage knowledge-based assets and entrepreneurial orientation?

RQ2. What are the key research gaps and potential avenues of future research on the identified thematic areas of research in the prior literature?

After a search of relevant articles based on intellectual capital, entrepreneurial orientation and knowledge management by adopting the following keywords such as “intellectual capital,” “human capital,” “structural capital,” “relational capital,” “renewal capital,” “knowledge management,” “entrepreneurial orientation,” “corporate entrepreneurship,” and “intrapreneurship.” The most articles were published in Journal of Intellectual capital, Journal of Knowledge Management, Knowledge Management Research and Practice, Strategy Management Journal, International Journal of Small Business, Strategic Entrepreneurship Journal, Entrepreneurship Theory and Practice and Journal of Small Business Management, among others. In turn, other keywords were included such as “absorptive capacity,” “organization learning,” “entrepreneurial proclivity,” “entrepreneurial posture,” “entrepreneurial disposition,” “entrepreneurial intensity,” and “firm-level entrepreneur” as further additional keywords. Hence, the final search string was “intellectual capital” OR “Human Capital” OR “Relational Capital” OR “Renewal Capital” OR “Structural Capital” OR “Knowledge Management” “absorptive capacity” OR “organization learning” OR “organization learning” AND “Corporate entrepreneurship” OR “Intrapreneurship” OR “Entrepreneurial Orientation” OR “entrepreneurial AND proclivity” OR “entrepreneurial AND posture” OR “entrepreneurial AND disposition” OR “entrepreneurial AND intensity” OR “firm-level entrepreneur. The authors used two journal platforms that are Scopus and Google Scholars and from a sample of 583 studies in WOS and 252 studies in Scopus, only 79 articles emerged as relevant for the present study.

The research ended up individuating new research themes which are designated in figure 2.

Overall, the key macro themes are:

1 Knowledge management in entrepreneurial firms

Considering the strategic role of knowledge management for firms, entrepreneurial orientation is moderated by knowledge management to get a competitive advantage and improve business performance (Mostafiz et al., 2021; Latif et al., 2021, Kusa et al., 2023).

This topic emphasizes the effective role of knowledge management in the entrepreneurial orientation (Kollmann et al., 2020; De Clercq et al., 2013; Martin-Rojas et al., 2013; Pittino et al., 2018).

2 Intellectual capital and entrepreneurial orientation

This new topic highlights the relevant role that intangible assets are assuming in the current economic era. This includes the capacity of a company to store, create, transfer and manage (Al-Jinini et al., 2019; Hayton, 2005; Al-Omouh et al., 2021).

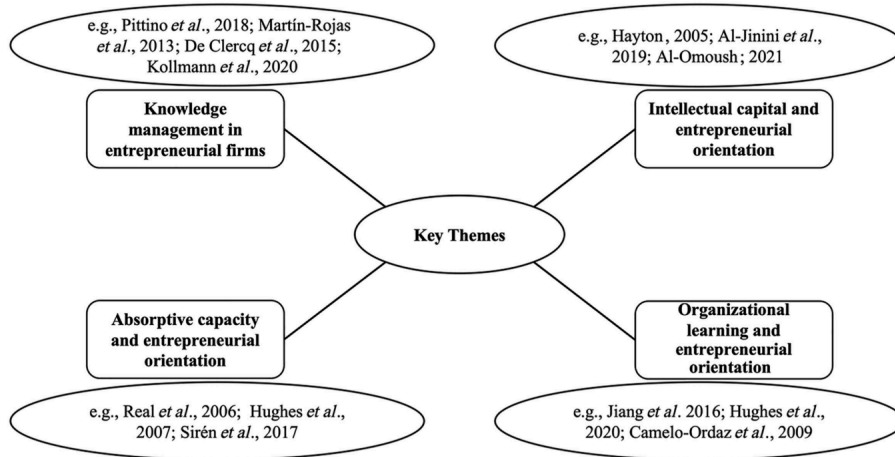
3 Organizational learning and entrepreneurial orientation

This new theme presents the importance of organizational learning for entrepreneurial strategy development (Dada and Fogg, 2016; Jiang et al., 2019). Organizational learning is defined as the capability of a firm to understand the new situation and adjust its behavior (Obeso et al., 2020; Castaneda et al., 2018).

4 Absorptive capacity and entrepreneurial orientation

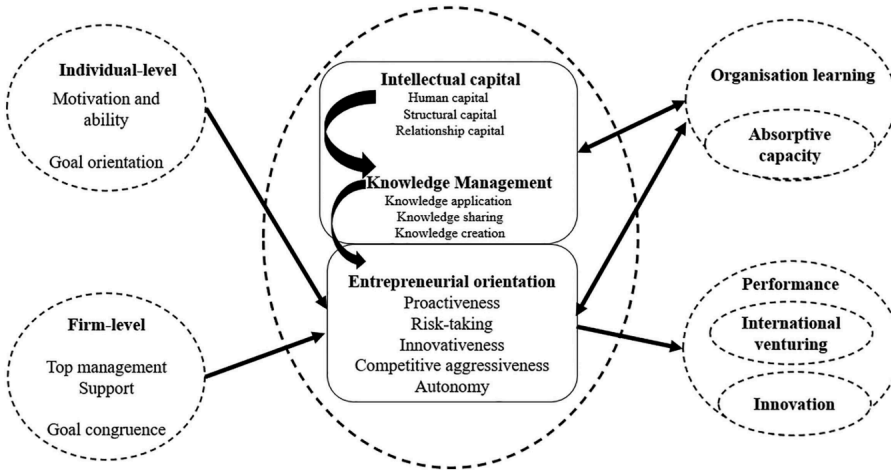
The last theme takes the attention of absorptive capacity which is the ability to use external knowledge to create, store and share new ideas. This is also connected with knowledge sharing in terms of complementarity and interdependency (Balle et al., 2020) and it is a source of innovation (Chichkanov, 2021; Arias-Pérez et al., 2020). Again, absorptive capacity is also relevant for project management (Moraes et al., 2020; Chang et al., 2022). In doing so, absorptive capacity leverages new entrepreneurial ideas and drives firms towards entrepreneurial orientation (Hughes et al., 2021).

Figure 2. New research themes



Concluding, the paper offers a new conceptual design which debates entrepreneurial orientation as an organizational learning process (Anderson et al., 2009; Wales et al., 2020) useful to compete in other markets (Lomberg et al., 2017). In turn, entrepreneurial orientation can be necessary to better understand firms' organizational structure and their ability to discover new opportunities (Wiklund and Shepherd, 2003). In doing so, entrepreneurial orientation is divided in innovation (Bouncken et al., 2016), international venturing (Chen et al., 2020), performance outcomes (Chirico et al., 2011). This is included in the big frame that connects intellectual capital, knowledge management and entrepreneurial orientation (figure 3).

Figure 3. New conceptual framework



4.12 Paper three (2023)

Title

La Sala, A., Iandolo, F., Mohiya, M., Farronato, N., & Caputo, F. (2023). Unfolding Resilience in Digital Platforms From a Microfoundations Perspective. IEEE Transactions on Engineering Management. DOI: 10.1109/TEM.2022.3200945

Key themes

Digital platforms, microfoundations, resilience, socio ecological systems (SESs), socioeconomic representations.

Insights and key outcomes

Through the lens of microfoundation, the article analyzes multi sided digital platforms focusing on the domain of resilience. It considers three processes of resilience - anchoring, objectification, and legitimization – to address the following research questions:

- 1) RQ.1 On which microfoundations digital platforms are built?
- 2) RQ.2 How do these microfoundations promote digital platforms resilience?

Especially, “1) Anchoring is the process by which new information is assimilated and categorized based on existing values and beliefs. 2) Objectification involves the use of metaphors, images, and other symbolic representations to give stable meaning to social facts. 3) Legitimization refers to the process by which representations are used to justify actions and beliefs.” (La Sala et al., 2023, p. 3).

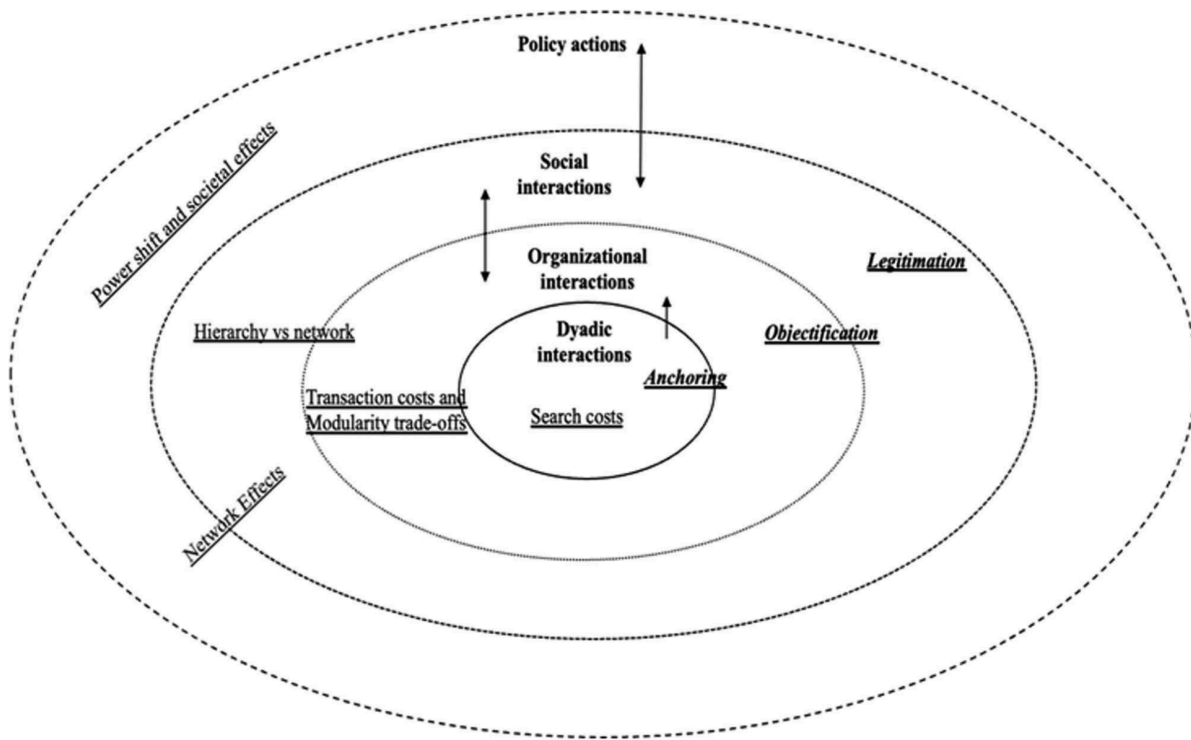
In this scenario, digital platforms have different characteristics which define them as ‘multisided’ (Hagiu & Wright, 2015). These characteristics are framed in four categories: “1) users as the target consumers to whom the solutions and services offered by platforms are addressed; 2) supply-side users who develop content and applications; 3) platform provider as the meeting point between the demand and supply side; and 4) platform sponsor that is the overall designer and owner of the intellectual property rights of the digital platform.” (Parker & Van Alstyne, 2012 in La Sala et al., 2023, p. 4). In turn, these multisided platforms have developed a form of resilience to deal with external and internal changes. Such resilience is examined regarding three tier of analysis: the first tier refers to the technical architecture of platforms, such as their scalability, modularity, and interoperability (Rochet & Tirole, 2003; Parker et al., 2016; Eisenmann et al., 2006; the second tier consider the organizational structure, including network effects, and the creation of user communities (Hagiu & Whight, 2019; Cusumano et al., 2019; Calabrese et al., 2021); and the last tier (un)intended societal effects and consequences stem from digital platforms (Van Dijck et al., 2018; Zuboff, 2019).

As emerged, the structural and behavioral dimensions of resilience in this context are distinguished in 1) dyadic 2) organizational, and 3) social/policy through which place the multi sided t platforms as a median level between market\society and single dyadic relationships. In this regard, a new research design is proposed as follows:

As shown in figure 1, “the anchoring process is related to the process of assimilating and categorizing new information consistently with the existing system of values and beliefs. It refers to all the characteristics of digital MSPs that concern interaction at the dyadic level falls herein, such as the reduced search costs and transaction costs for users, the definition of interaction rules between the platform sponsor and the individual providers (intellectual property rights, access rules, etc.), and the definition of possible closing and opening rules of the platform and modularity tradeoffs defined at the dyadic relationship level. 2) The objectification process is based on the use of metaphors, images, and other symbolic

representations that allow social facts to be given a stable meaning. Herein, they included the characteristics of digital MSPs concerning interaction at the organizational level. Such a process refers to the organizational configurations at the level of hierarchy and markets / Trabucchi & Buganza, 2020; Kretschmer et al., 2022) and, thus, to the distribution of power and authority. 3) The legitimation process refers to the process by which representations are used to justify actions and beliefs. This process is related to the characteristics of digital MSPs concerning interaction at the societal level that reverberate on policy mechanisms and choices. This includes the potential and characteristics of platforms capable of acting on the basic configurations of industries and society and consequently triggering the need for regulatory and policy actions (Abbate et al., 2015). As shown in Fig. 1, at the social level, the microfoundations perspective underlines digital platforms contribution to design effective governance mechanisms to promote resilience. Indeed, platform behavior is a function of both social and economic representations of the wider social system. Along this line of thought, it is possible to underline how the different role of digital platforms configuration in terms of hierarchy or networks may result in a different shift of social power, being critical in promoting not solely platform stability but also long-term social viability. Moving from the social to the organizational and dyadic level, it becomes clear how platforms' behavior strongly depends on microfoundations at a dyadic level, such as transaction costs for users and interaction rules between the platform sponsor and the individual providers (e.g., intellectual property rights, access rules, etc.). Indeed, the definition of platforms rules of closeness/openness, and the modularity/scalability degree at the dyadic level are themselves the product of social and economic representations in which single decision-makers are immersed: by fostering the creation of stronger user communities and developer networks, platforms can create a sense of shared ownership among participants, which in turn can promote platform sustainability and resilience. This ensures that key decisions are made in a transparent and accountable way, promoting legitimacy and trust.” (La Sala et al., 2023, p.4).

Figure 1. Research model



Source: La Sala et al., 2023

The paper enforces the literature on digital platforms and ecosystems and offers new insights for practitioners and policymakers to improve networking and ability of companies to react and deal with new challenges. There is the need of ecosystem participation to address challenges and get rid of inequality and digital gap which calls for the side dimension of the whole framework of this PhD thesis, that is the Quintuple Helix Innovation System. Concluding, if from one side the market is developing on the digital space and so new economic practices and challenges are in place, on the other side society is involved in this process and both – companies and society need to be more resilient through social, organizational and dyadic interactions.

4.13 Paper four (2023)

Title

Scuotto, Deniz, Farronato, Alon 2023. A destination's personality as a factor in tourists' environmental knowledge management. Journal of Knowledge Management. forthcoming

Key themes

environmental knowledge, destination personality, tourist personality, sustainability, knowledge management

Insights and key outcomes

The present paper emphasizes one of the subset of the circular economy, that is environmental knowledge management (EKM). It explores a key intangible asset as knowledge in the tourism industry. In turn, it takes in consideration destination personality and tourists' personalities which are also connected with behavioral intentions.

The study on EKM brings up some reflection on the increasing warning about environmental issues and sustainability which are developed to bridge up the gap on EKM that impact tourism destinations which requests destination personality. From the knowledge management perspective, the paper highlights the need of gathering more knowledge and awareness on environmental issues which drives tourists' and destination personality. The paper explores a sample of 2,222 young Chinese tourists by adapting two stages of analysis: tourists' personalities and the personality of the destination are categorized by using the Kruskal-Wallis test; while to assess the following hypotheses the SPSS regression model is employed.

SPSS regression model so as to test the following hypotheses:

H1. *The more EKM tourists have, the more likely they are to choose a destination with a personality that reflects environmental concerns.*

H2: *There is a positive relationship between a destination's personality and tourists' personalities.*

H3: *There is a positive relationship between a destination's personality and satisfaction visiting it.*

H4: *There is a positive relationship between a destination's personality and behavioral intentions.*

As shown in the paper, the results are reported below:

4. Findings

4.1. The measurement model

To assess reliability and validity of the measurement model we employed a confirmatory factor analysis (CFA) (Anderson & Gerbing, 1988). Table 2 shows that all loading factors' values of all indicators are more than 0.70. Further, all Cronbach Alpha (CA) and composite reliability (CR) have values higher than 0.70 and all average variance extracted (AVE) have values of more than 0.50 (Table 3). The analysis shows a good fit with a value of CMIN/DF = 3.02, CFI = .81, IFI = .878, TLI = .889, SRMR = 0.039 RMSEA = 0.058. Those values are considered acceptable by Hu & Bentler, 1999; Joreskog & Sorbom, 1993). These tests confirmed the reliability and validity of the study constructs (Hair et al., 2017)

Table 2. The measurement model

	<i>Constructs</i>	<i>Loadings</i>
I. Destination Personality (DP)	Exciting	0.911
	Sophisticated	0.854
	Active	0.796

	Dependable	0.750
	Hospitable	0.928
	Rugged	0.893
II. Tourists' Personality Traits (TPTs)	Openness to experiences	0.843
	Conscientiousness	0.788
	Extraversion	0.841
	Agreeableness	0.718
	Neuroticism	0.833
III. Tourist Satisfaction Destination (TSD)	Supporting needs	0.945
	Tourists' sustainable expectations	0.898
	Tourists' predictive personality	0.901
IV. Behavioral Intentions (BI)	Likelihood of revisiting the same destination	0.725
	Recommending the destination to others	0.812
	Behavioral intentions of revisiting the same destination	0.891

V. Environmental Knowledge Management (EKM)	Knowledge about the maintenance of the ecological balance will enhance sustainable tourism	0.892
	Knowledge that the preservation of natural resources will improve sustainable tourism	0.788
	Knowledge about environmental issues and the relevance of sustainable tourism	0.814

Source: own elaboration

Table 3. Internal consistency and reliability, and correlations between the study's measures

		(1)	(2)	(3)	(4)	(5)
(1)	DP	1				
(2)	TPTs	0.672**	1			
(3)	TSD	0.511**	0.639**	1		
(4)	DRI	0.575**	0.532**	0.626**	1	
(5)	EKM	0.891**	0.542**	0.738**	0.590**	1

** : Correlation is significant at the 0.01 level (two-tailed).

Source: own elaboration

4.1 Kruskal - Wallis test

The results of the Kruskal-Wallis rank sum test showed significant differences ($p - value < _ = 0.05$) between the respondents. The highest ratings associated with destination personality were *exciting, sophisticated, hospitable, and rugged*. Table 4 lists the results.

Table 4. Kruskal-Wallis rank sum test for aspects of the destination’s personality

Interaction	χ^2	Df	<i>P</i>-value	Φ_c	ϕ_c level
Exciting	2.340	1	0.105	0.030	very small
Sophisticated ~	4.720	1	0.020	0.045	very small
Active ~	0.214	1	0.638	0.009	very small
Dependable ~	0.876	1	0.338	0.017	very small
Hospitable	2.032	1	0.138	0.027	very small
Rugged	9.355	1	0.002	0.058	very small

Source: own elaboration

Results from the Kruskal-Wallis rank sum test showed significant differences ($p - value < \alpha = 0.05$) in the personality factors. As Table 5 indicates, the personality traits that scored highest were *openness to experience* and *agreeableness*.

Table 5. Kruskal-Wallis rank sum test for personality traits

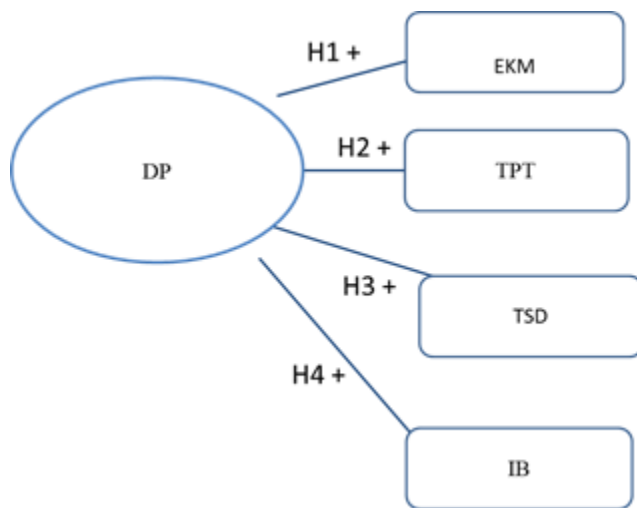
Interaction	χ^2	Df	<i>P</i>-value	Φ_c	ϕ_c level
O ~ Var	27.054	1	0	0.098	very small
C ~ Var	1.757	1	0.185	0.025	very small
E ~ Var	2.405	1	0.121	0.029	very small
A ~ Var	7.001	1	0.008	0.050	very small
N ~ Var	1.308	1	0.253	0.021	very small

Source: own elaboration

4.2 SPSS model

Based on the data we collected, we developed a research design connecting five variables. “Destination personality (DP)” is a predictor variable that can affect “tourist personality traits (TPTs),” their “tourists’ satisfaction destination (TSD),” their “behavioral intentions” (BI), and their “environmental knowledge management (EKM)” (see figure 1).

Figure 1. Research Model



Source: own elaboration

The results supported H1, which predicted a positive relationship between a destination’s personality and tourists’ EKM ($T=68.7, p < 0.001$) (see table 6)

Table 6. Results of model 1

Model	R	R-squared	R-squared adapted	Standard error

4	,997	,995	,995	888794.163
---	------	------	------	------------

Model		B	Standard error	Beta	T	Sign.
4	Constant	1648.049	211233,421		,008	,994
	DP	,992	,014	,997	68,778	<,001

Predictor (constant): DP

Dependent variable: EKM

Source: Own elaboration

Again, the result also supported H2 expecting a positive relationship between the destination's personality and the tourists' personality ($T=21,3; p < 0.001$) (see table 7).

Table 7. Results of model 2

Model	R	R-squared	R-squared adapted	Standard error
1	,975	,950	,948	2085897.84

Model		B	Standard error	Beta	T	Sign.
1	Constant	474354.05	495740,584		,957	,348
	DP	,724	0,34	,975	21,379	<,001

Predictor (constant): DP

Dependent variable: TPTs

Source: Own elaboration

The results also supported H3 by demonstrating that there was a positive relationship between a destination's personality and satisfaction with the destination ($T= 24,9; p < 0.001$) (see table 8).

Table 8. Results of model 3

Model	R	R-squared	R-squared adapted	Standard error
2	,981	,963	,961	1584182.02

Model		B	Standard error	Beta	T	Sign.
2	Constant	280507.89	376501,334		,745	,463
	DP	,640	,026	,981	24,905	<,001

Predictor (constant) DP

Dependent Variable: TSD

Source: Own elaboration

H4 was also supported, showing a significant correlation between the destination's personality and behavioral intentions ($T= 13,1; p < 0.001$) (see table 9).

Table 9. Results of model 4

Model	R	R-squared	R-squared adapted	Standard error
3	,937	,879	,874	3502013.18

Model		B	Standard error	Beta	T	Sign.
3	Constant	442532.742	832298,698		,532	,600
	DP	,750	,057	,937	13,198	<,001

Predictor (constant): DP

Dependent variable: IB

Source: Own elaboration" (Scuotto et al., forthcoming)

The research makes interesting advancements in the knowledge management literature, focusing on EKM and its branches of destination personality and tourists' personality along with intention behavior. Yet, it has noticed that local communities need to collaborate more with marketers, cities and tourists in order to avoid environmental destruction. There is more need of 'environmental awareness' to address tourists in good manners and respect for their destination. This would enhance such awareness and consciousness towards sustainable tourism which meets the sustainable development goals n.8 and also n.12 based on "responsible consumption and production.

4.14 Conference paper five (2023)

Title

Spinazzola matteo; nicola farronato; veronica scuotto; marco pironti (2023), Entrepreneurial ecosystems' transition to sustainability: exploring the demand for green talents in 20 global cities, Euram Conference 2023 ISBN 978-2-9602195-5-5

Key themes

Entrepreneurial Ecosystem; Green Talent; Online Job Vacancy; Green Skill; Quadruple Helix

Insights and key outcomes

This work considers the macro scenario of sustainable and entrepreneurial ecosystems (EEs). It explores such ecosystems and their transition to sustainability by the lens of the Quadruple Helix. In turn, the study investigates the demand for green talents as they are recognised to be a source of innovation and growth. Green talents are considered people who collect knowledge, expertise and capabilities throughout their life and also bring value to the green economy (Laroche et al., 1999; Odugbesan et al., 2023; Ogbeibu et al., 2022; González-Masip et al.,

2019). Specifically, they are defined “as workers possessing analytical and technical knowledge and skills related to the design, monitoring, production, and improvement of environmentally-impactful products or processes a (Glen et al., 2009; Sern et al., 2018 in Spianzzola et al., 2023).

It was encouraged by the strong need to achieve the Sustainable Development Goals (SDGs) and the lack of studies in this field (Hickmann et al. 2022; Biermann et al. 2022; Spinazzola and Cavalli 2022).

EEs were analysed by Startup Genome 2022 List of city ecosystems from which the Authors identify ‘20 EEs hosting the most advanced communities of entrepreneurs in the world’, including almost 3.5 million online job vacancies (OJVs) (European Training Foundation 2022; Lovaglio et al. 2018) (table 1).

Table 1. Startup Genome top 20 ecosystems

Ecosystem	Startup Genome Ranking	OJVs
Silicon Valley	1	220,419
London	2 (tie)	259,632
New York City	2 (tie)	471,392
Boston	4	310,573
Beijing	5	108,680
Los Angeles	6	349,632
Tel Aviv	7	8,435
Shanghai	8	108,847
Seattle	9	237,556
Seoul	10	7,333
Washington, D.C.	11	295,307
Tokyo	12	83,797
San Diego	13	190,288
Amsterdam-Delta	14	72,135

Paris	15	162,037
Berlin	16	83,168
Toronto-Waterloo	17	51,734
Singapore	18	71,179
Chicago	19	310,715
Sydney	20	43,888
Total number of OJVs		3,446,747

Source: Spinazzola et al., 2023

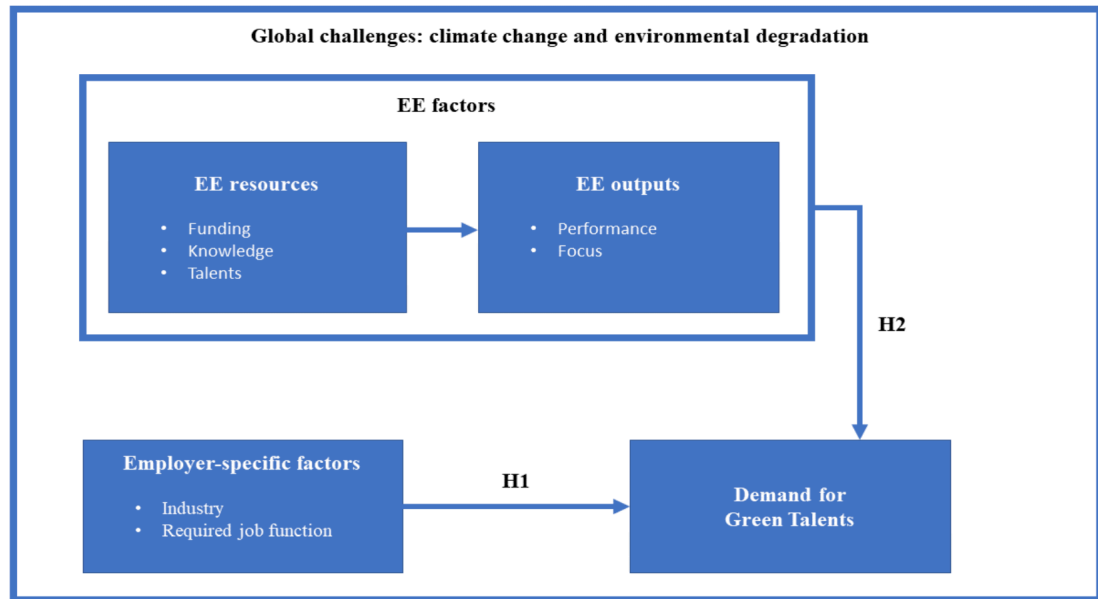
This drove the development of two hypotheses as follows:

- H1 Employer-specific factors influence the demand for Green Talents
- H2. Local EE factors influence the demand for Green Talents

Which are embraced in a new research design (figure 1)

The research design shows the variables studied such as EEs factors divided in EE resources (e.g. Funding, Knowledge, and Talents) and outputs (performance in creating new business ideas and focus on sustainability) and employer-specific factors (e.g. industry and required job function) (Stam & van de Ven, 2021). With the growing pressure of environmental and social issues, the authors seek to test if these variables impact the demand of green talents.

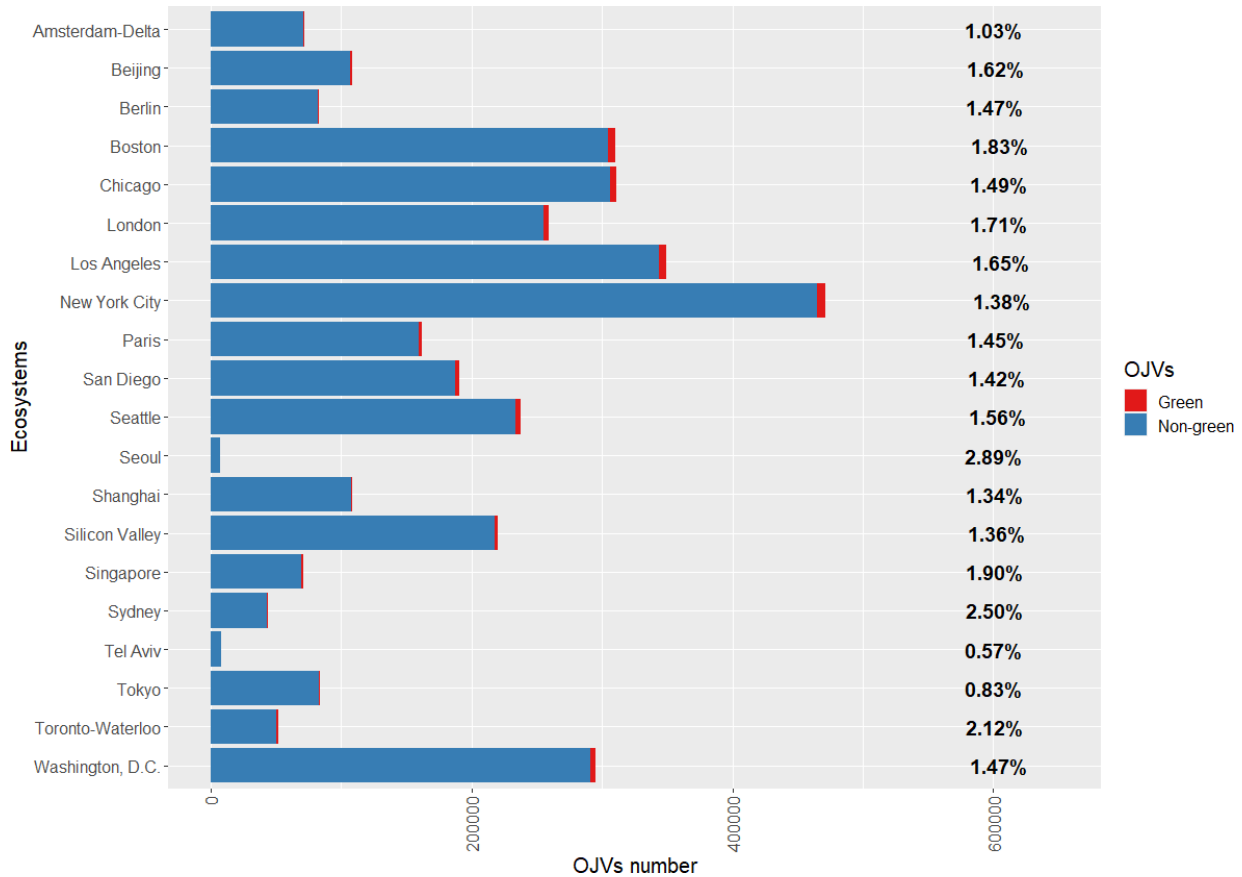
Figure 1. Research Design



The choice of focusing on OJV was motivated by the increasing demand of this type of job stemming from mainly STEM disciplines (Cedefop et al., 2019) which was analysed along with sector, job function and demand for green talent skills and knowledge by R studio, open source software.

In this line some preliminary results are presented at the EURAM conference 2023. In details, it has noticed “that only 52,034 (1.53%) of all OJVs required green skills or knowledge. This number ranged from 48 (0.57%) in Tel Aviv, 206 (2.89%) in Seoul, 692 (0.83%) in Tokyo, 738 (1.03%) in Amsterdam, 1,070 (2.50%) in Sydney, 1,074 (2.12%) in Toronto-Waterloo, 1,208 (1.47%) in Berlin, 1,324 (1.90%) in Singapore, 1,440 (1.34%) in Shanghai, 1,732 (1.62%) in Beijing, 2,322 (1.45%) in Paris, 2,656 (1.42%) in San Diego, 2,953 (1.36%) in the Silicon Valley, 3,659 (1.56%) in Seattle, 4,269 (1.47%) in Washington D.C., 4,370 (1.71%) in London, 4,562 (1.49%) in Chicago, 5,593 (1.83%) in Boston, 5,686 (1.65%) in Los Angeles, and 6,432 (1.38%) in New York. Accordingly, New York and Los Angeles emerge as the cities posting the largest number of Green OJVs”. However, the demand of green talents is still small although its growth (Figure 2).

Figure 2. Ecosystems and OJVs



Source: Authors' elaboration

Other differences have emerged considering the sector. As shown figure 3, from 167 Green OJVs (0.66%) for the Legal sector, to 522 (3.04%) for Agriculture, to 792 (1.50%) for Technological Manufacturing, to 839 (1.95%) for Transportation, to 866 (0.34%) for Finance, to 933 (0.41%) for Consumer Goods, to 1,202 (0.55%) for Health, to 1,214 (1.20%) for Education, to 1,222 (1.70%) for Arts, to 1,352 (0.52%) for Consumer Services, to 1,382 (2.77%) for Government, to 1,708 (1.31%) for Biotechnology, to 3,249 (12.88%) for Mining and oil, to 3,341 (0.38%) for Technology, to 4,384 (2.85%) for Manufacturing, to 6,110 (19.30%) for Utilities, to 10,114 (6.67%) for Construction, and 11,880 (1.92%) for Corporate services. Analysing the sector diversity also by cities, it has noticed that “one macro cluster of predominantly US-based EEs is possibly identified (New York, Los Angeles, Boston, London,

Washington, D.C., Seattle, and Chicago), indicating a stronger similarity in industrial patterns between these cities than with the remaining EEs” (Figure 4).

Figure 3. Sector diversity

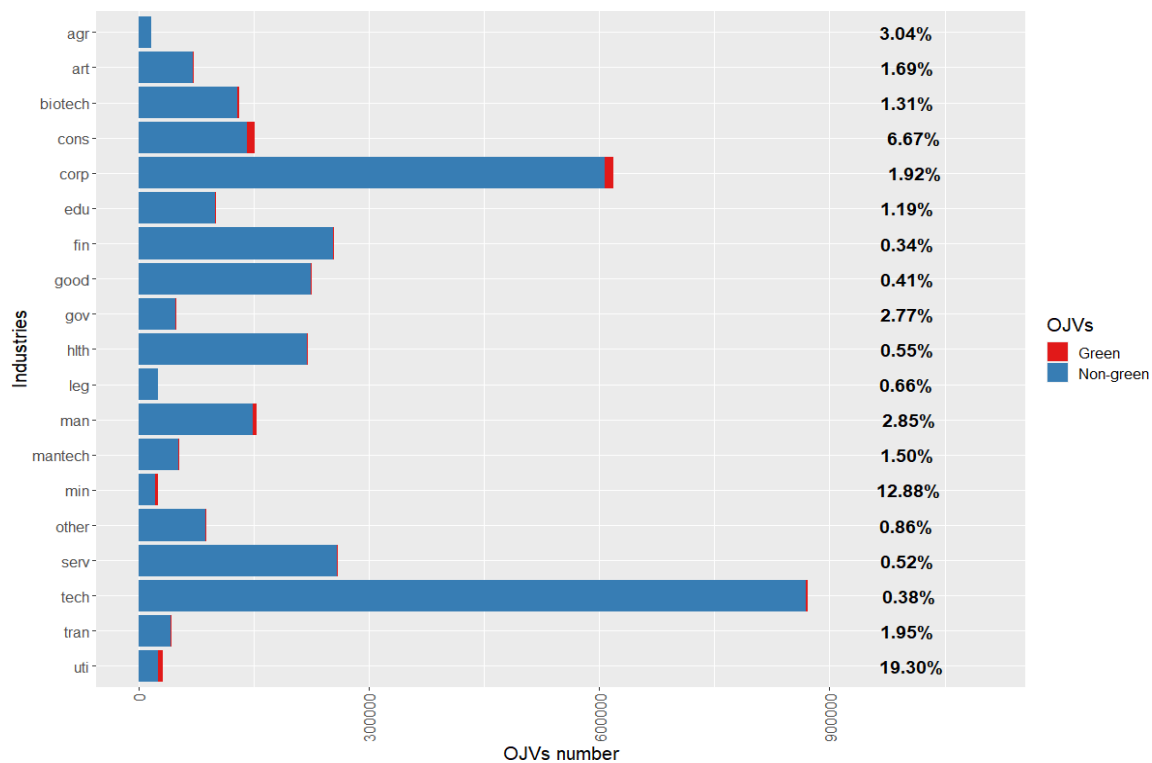
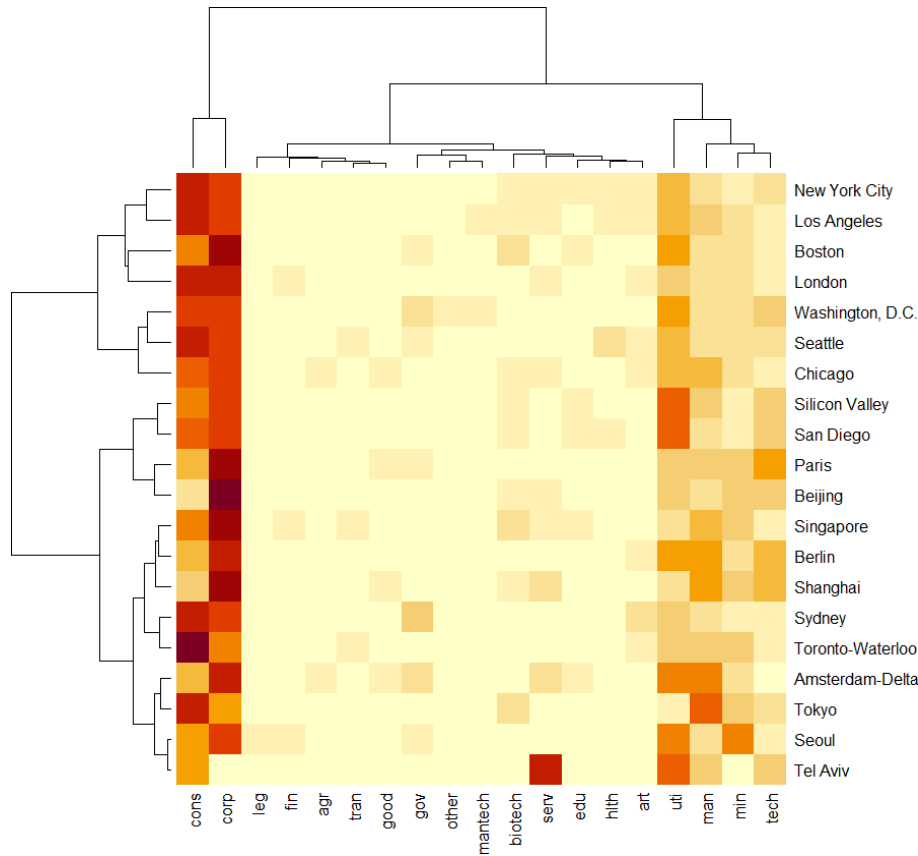


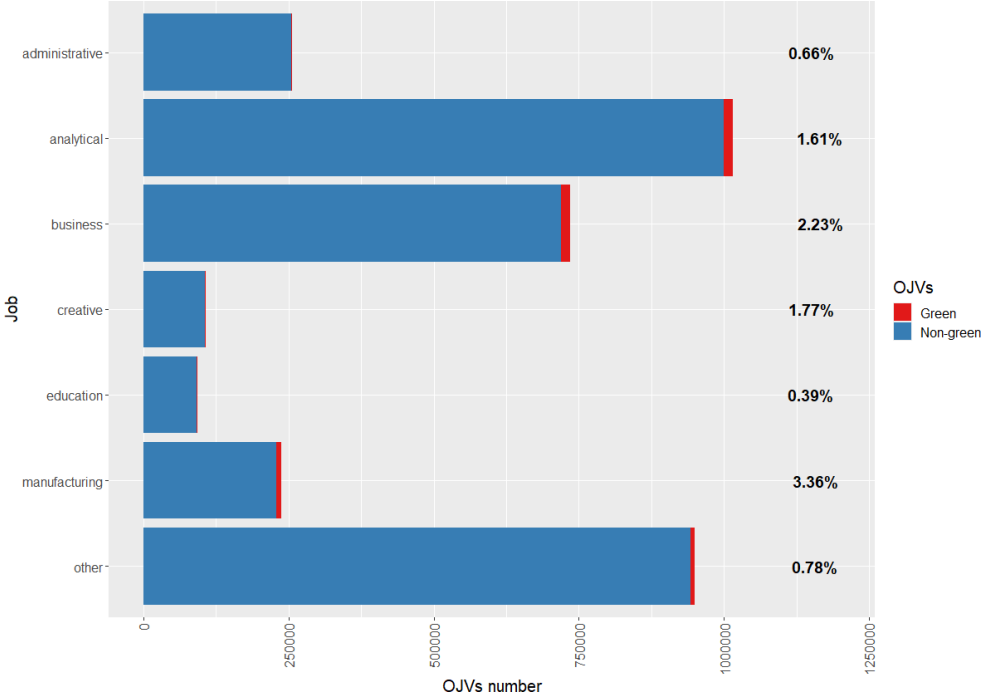
Figure 4. Sector diversity and EEs



Source: Authors' elaboration

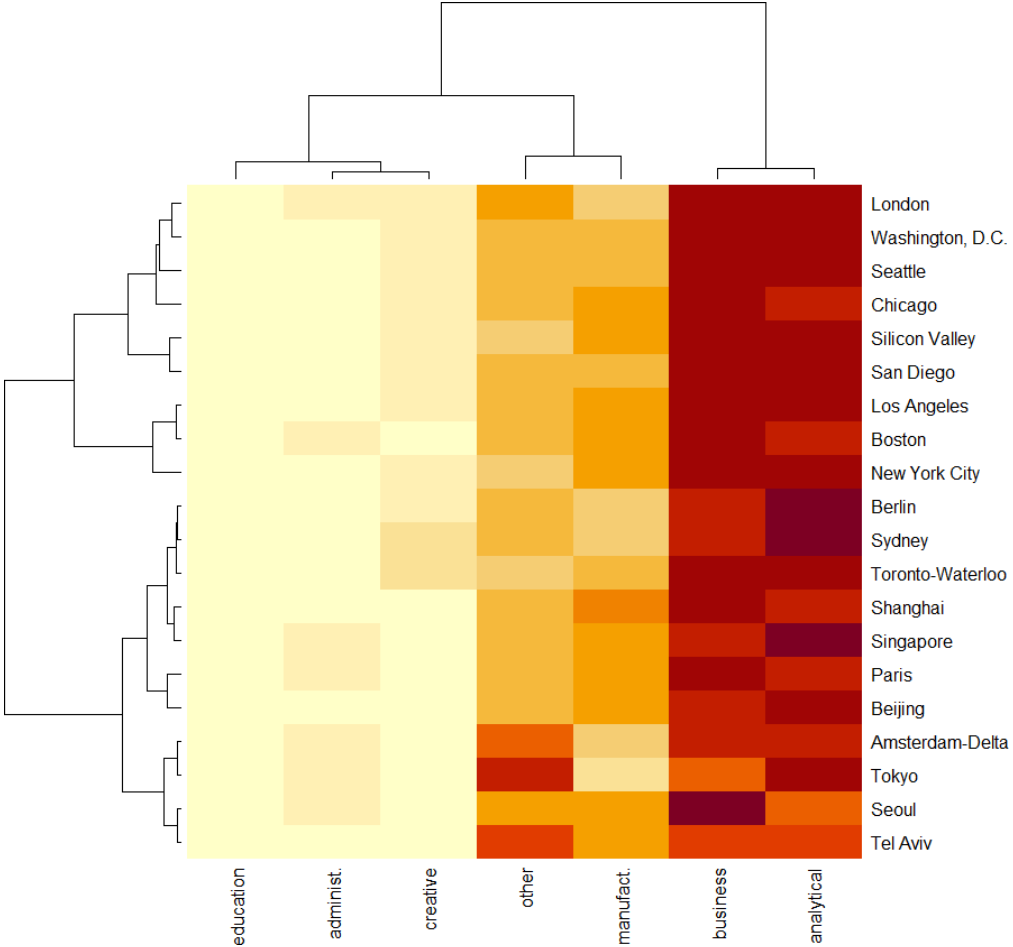
Another analysis was conducted on job function which presents the following trends: 361 (0.39%) are in Education, 1,694 (0.66%) are Administrative positions, 1,904 (1.77%) are Creative positions, 7,958 (3.36%) are Manufacturing positions, 16,316 (1.61%) are Analytical positions, 16,391 (2.23%) are in Business, and 7,777 (0.78%) fall in the "Other" category. Overall, the most relevant are business, manufacturing and analytical jobs (Figure 5). Alongside, this analysis considers EEs which do not show any relevance difference (figure 6).

Figure 5. Job function diversity



Source: Authors' elaboration

Figure 6. Job function diversity and EEs



Concluding to evaluate the research design, a logistic regression model was employed. The multicollinearity was examined (Table 2) and the model was assessed by the McFadden pseudo-R² test. “It provided an output of 0.138, hence indicating that the current model is able to explain only a portion of the variance in the data. Nonetheless, the current model effectively identifies a multiplicity of local EE and employer-specific factors as statistically significant in determining the probability of publishing OJVs to acquire new Green Talents (Table 3).

Table 2. Multicollinearity test

Factors	GVIF	Df	GVIF^{^(1/(2*Df))}
Performance	1.530689	1	1.23721
Funding	2.452816	1	1.566147
Knowledge	2.102527	1	1.450009
Talent	2.049222	1	1.43151
Focus	1.593256	1	1.262242
Job	1.130392	6	1.010266
Industry	1.176764	18	1.004532

Table 3. Logistic regression output

Coefficients	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-4.850	0.067	-71.872	0.000	***
Performance	-0.014	0.002	-5.880	0.000	***
Funding	0.029	0.003	9.207	0.000	***
Knowledge	0.037	0.003	13.845	0.000	***
Talent	-0.0098	0.0034	-2.9147	0.004	*
Focus	0.022	0.003	7.946	0.000	***
Job:analytical	0.977	0.028	35.247	0.000	***
Job:business	1.140	0.028	41.128	0.000	***
Job:creative	0.948	0.037	25.983	0.000	***
Job:education	-0.1496	0.0627	-2.3859	0.017	.
Job:manufacturing	1.412	0.029	48.310	0.000	***
Job:other	0.304	0.029	10.398	0.000	***
Industry:art	-0.471	0.061	-7.698	0.000	***
Industry:biotech	-0.664	0.059	-11.278	0.000	***
Industry:cons	0.921	0.054	17.126	0.000	***
Industry:corp	-0.288	0.054	-5.371	0.000	***
Industry:edu	-0.581	0.061	-9.532	0.000	***
Industry:fin	-1.935	0.064	-30.281	0.000	***
Industry:good	-1.909	0.065	-29.590	0.000	***
Industry:gov	0.1285	0.0598	2.1477	0.032	.
Industry:hlth	-1.331	0.061	-21.834	0.000	***
Industry:leg	-1.074	0.098	-10.953	0.000	***
Industry:man	0.0487	0.0554	0.8782	0.380	
Industry:mantech	-0.634	0.064	-9.859	0.000	***
Industry:min	1.573	0.057	27.825	0.000	***
Industry:other	-0.999	0.065	-15.370	0.000	***
Industry:serv	-1.745	0.061	-28.807	0.000	***
Industry:tech	-1.924	0.056	-34.375	0.000	***

Industry:tran	-0.253	0.065	-3.922	0.000	***
Industry:uti	1.915	0.055	34.964	0.000	***

“Starting from EE variables, it was found that every unitarian increase in the Performance of the EE decreases this probability by -1.43% (p-value < 0.000) and that increases in Talent availability decrease it by -0.97% (p-value < 0.05), while availability of funding increases the same probability by +2.94% (p-value < 0.000), availability of Knowledge by +3.80% (p-value < 0.000), and EE Focus increases it by +2.24% (p-value < 0.000).

Moving to the Job functions, compared to Administrative ones, OJVs for Manufacturing positions display a +310.45% increase in probability (p-value < 0.000), followed by +212.59% increase of Business ones (p-value < 0.000), by +165.54% increase of Analytical ones (p-value < 0.000), and by +158.18% increase of Creative ones (p-value < 0.000). Last, in comparison to the Agriculture sector, a major increase of +578.91% for Utilities (p-value < 0.000) is observed, of +382.04% for Mining and oil (p-value < 0.000), and of +151.25% for Construction (p-value < 0.000). Despite the high absolute values of Green OJVs, Corporate services displays a -25.01% (p-value < 0.000), and additional underperforming sectors include Finance and Banking (-85.86%, p-value < 0.000), Technology (-85.40%, p-value < 0.000), Consumer Goods (-85.18%, p-value < 0.000), Consumer Services (-82.53%, p-value < 0.000), Health (-73.58%, p-value < 0.000), and Legal (-65.82%, p-value < 0.000)” (Spinazzola et al., 2023; p.20-22).

This work brings up new insights for the EEs, entrepreneurship, and innovation scenario. The green talents are the new necessary resource of the current era; they are a source of knowledge and skills and offer new solutions for environmental and social challenges. The green talents can be included in the open innovation participatory ecosystem model which can leverage sustainable and circular business models, stimulate new entrepreneurial ideas in EEs engaging with entrepreneurs and citizens (or consumers).

4.15 Summary

The present chapter represents a debate on the Author's 14 scientific outputs, produced in three years of his PhD journey. For each paper, conference paper, book and book chapter, the key insights are explained by the lens of the theoretical framework based on the combination of microfoundation and Quintuple Helix Innovation System. It is interesting to see the whole research journey from which he has delivered a variety of publications, characterized by entrepreneurial city, green economy, open innovation participatory model. Alongside, the Author has also delivered new companies which are going to be described in the next chapter.

Turin as a prototype of Start-up city driven by smart mobility

5.1 Introduction

The fifth chapter conveys the vision for Turin to become a prototype of a start-up city driven by smart mobility. Considering the industrial heritage of the city, formerly a recognized city of automobiles in the world, Turin experienced a deep transformation when the manufacturing focus of its main industry moved out. In these circumstances institutions, companies and research organizations understood that a new model for the city of the future was needed, hence a proactive role of the city in the global start-up ecosystem. Beginning in 2016 with the experience of Torino Living Lab, the smart city strategy of the Piedmont capital has been fine tuned toward a position as a city of innovation which would allow easier access to urban scale experimentation to global players. Turin City Lab framework has been introduced in 2019 as an evolution of the EU-supported Living Lab programme. Owing to this shift, the innovation team of the City's Mayor could boost the transition of the entrepreneurial ecosystem from an industrial mindset towards a more comprehensive emerging technology open innovation participatory ecosystem (Cillo et. al., 2020). Through the 2020 - 2021 pandemic years, the city stood up and accelerated its start-up friendly model thanks to the activation of world class start-up acceleration initiatives like Techstars and Plug & Play, both hosted at the most relevant innovation hub. OGR Tech. Turin has entered the global Startup Genome ranking in 2022, which shows a potential for the future to evolve and become a leading start-up city in Italy, also in view of the fragmented distribution of about 25,000 start-ups in the Italian peninsula. There are at least two key drivers which boosted this ascend of Turin as city of innovation and start-ups: first of all a fast

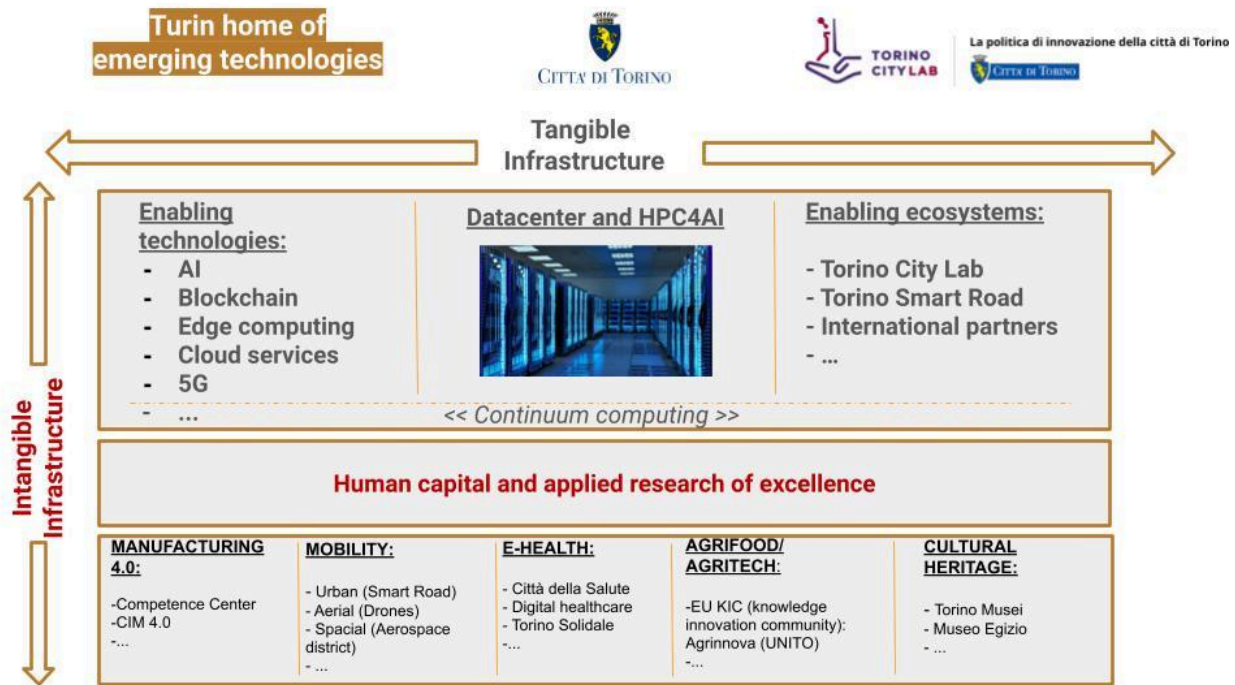
growing city's innovation and entrepreneurial ecosystem built on the Turin City Lab partnerships, secondly a unique holistic smart mobility vision which could foster cross-domain contamination between smart road, urban air mobility and space mobility actors. In chapter 5 the author discusses the favorable conditions he could find in Turin, as entrepreneur himself, to start-up 2 new companies during his PhD journey, one in the smart road context, Plasy, one in the space economy context, Cosmodity. Moreover he has been a key contributor in the reboot of an existing start-up in the urban air mobility space, Immodrone. According to his personal experience the nexus between the start-up city model explored in this thesis and the circular innovation effect behind the holistic smart mobility vision of the city could provide the ground for becoming a unicorn city, whereas such a condition implies at least the presence of a start-up company valued more than one billion US dollars.

5.2 Turin home of emerging technologies

The global number of start-ups is growing fast, according to the most relevant observatories such as Startup Genome. It is calculated that the aggregated turnover generated by all of these tech companies globally accounts for about 7 Trillion US dollars. That means if a “Start-up Country” could exist, it should attend G7 meetings. The magnitude of the start-up community is expanding its reach and it is luring the new generations not only in the developed world but also in those countries and rural areas in which internet penetration and access to technology used to lay behind. Moreover, considering the average growth of the world population and its geographical distribution, it is expected that by 2050 about 10 billion people will populate planet earth. The United Nations research center published a statistic which estimates that by the same year about 70% of people will live in cities (www.ourworldindata.org). Thus citizens will expect cities to become home of emerging technologies in order to provide better services, more inclusion and higher wealth opportunities. In 2021 Turin won

the Italian challenge for becoming the first “Home of emerging technologies”, a new programme launched by the Italian Ministry of Economic Development to support cities in their transition towards smarter territories based on their innovation footprint. One of the city’s unique selling points was its attitude of welcoming experimentations at urban scale, thanks to the Turin City Lab policy, which could provide an easier and faster track to start-ups for engaging with the municipality in a proof of concept of their solutions. As shown in figure 1 below the strengths of the city have been pitched taking a dual infrastructure lens for combining the tangible innovation assets (such as technological enablers with an advanced maturity status in terms of deployment, information technology physical infrastructures as datacenters and high performance computing, existing ecosystems made of innovators and entrepreneurs) with some key intangibles. Among the latter, human capital plays a crucial role, based on the idea that a city able to attract start-ups will gain a consistent talent acquisition. Furthermore, thanks to the high level applied research developed in Turin and performed by public and private organizations, talent mobility from abroad has been a trend the city has experienced constantly.

Figure 1: Turin home of emerging technologies infrastructures



Source: Author's elaboration

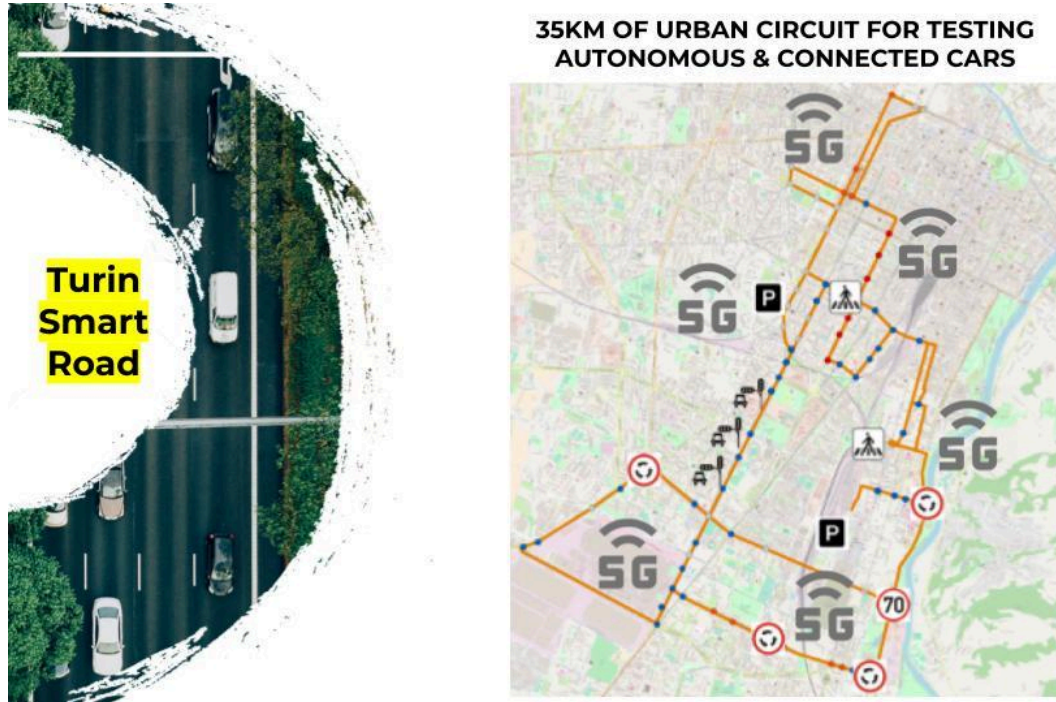
Worth noting that a key driver in the process of becoming a home for emerging technologies, thus leveraging on the attraction of technology start-ups, is the presence of innovation accelerators (Brown et al., 2019). These programmes, in fact, are run periodically by specialized organizations and have the goal to scout the best founders teams and engage with them in a specific city to accelerate their start-up processes. For instance in 2020 Techstars, an american company specialized in the delivery of investments and acceleration programs for start-ups, has chosen Turin to run its smart mobility european program. This opportunity has brought about 12 new start-ups per year during the last 3 years, as well as it has generated an active participation for the innovation and entrepreneurial ecosystem of the city. According to the World Economic Forum, the leaders of the most advanced smart cities in the world are committed to growing their local innovation and entrepreneurial

ecosystem investing in acceleration programmes, both publicly and privately run. Turin has also started investing towards the attraction of further acceleration programs, with a current plan of about ten of them running in town. The key markets they cover are smart mobility, smart cities, space economy, education, gaming, sustainability.

5.3 Turin Smart Road: the start-up case of Plasy

Owing to a world class reputation of “city of the automobiles” gained from the FIAT story first, then FCA, Turin has obtained the new Italian Museum of automotive from the Italian Ministry of Transportation. Notwithstanding its fifty years of automotive manufacturing center, the city has been recently opening more and more towards new concepts of mobility, mainly as an impact of its start-up friendly policy. The Turin Smart Road project started in 2017, just after the European Smart Road Decree was published for the first time. The idea was to create an urban testing area for connected and autonomous vehicles. The Mayor and its cabinet pre-authorized a 35 kilometers circuit in 2018, well ahead of any other Italian city. The Turin Smart Road, as shown in figure 2, contemplated the possibility to equip a traditional road infrastructure with state-of-the-art technologies enabling smart driving. For instance 5G telecommunication standards could allow low latency vehicle to vehicle communication; edge computing could allow a faster response in case of micro decision making processes that a vehicle could perform while driving; Internet of Things sensors could provide detailed road conditions reporting in real time, thus generating more efficiency during road maintenance.

Figure 2. Turin Smart Road



Source: Turin City Lab archive

The Turin Smart Road initiative has gained support across the European smart cities as one of the first implementations of the European smart road decree. It has moreover attracted the interest of international groups of companies working on the new standards for autonomous driving such as 5GAA. Lastly it has stimulated a growing number of start-ups to experiment their solutions in Turin.

During his PhD journey the author has been contributing to this process becoming one of the founders of the project PLASY, a start-up willing to develop a new solution for identifying and mitigating dangerous behaviors while driving. The origin of these new ventures lies in the European Commission's Vision Zero statement dated 1990: "Vision Zero is a strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all". The reality is that most of the cities in Europe are very far from reaching Vision Zero objectives, including Turin, where urban car accidents have grown double digits during the period 2020-21 (source: Turin Local

Police). The problem seems to lie on the lack of effective technology for addressing the so-called “driving dangerous behavior challenge”. In fact the growing number of accidents at urban scale has exponentially increased due to new modern tools like e-cigarettes, smartphones, smart devices, which are used by the driver while performing a driving vehicle task. Plasy team has developed a new approach to tackle this market problem and help cities to reduce these casualties. The solution is based on a combination of emerging technologies such as artificial intelligence (for driving patterns recognition), fixed and mobile smart cameras (for capturing the video footage needed by the system to perform its sophisticated data analysis), 5G connectivity (for reducing latency between the dangerous behavior and the correction). Thanks to Turin’s home of emerging technologies programme, Plasy has started a pilot project with the municipality during 2023 and the team could collect almost 50,000 data points through a single camera installation, to validate the market problem. The next expected steps will be the proof of concept extension to a higher number of installations within the city road system in order to validate the approach and move forward to a commercial stage. The story of Plasy shows how important a start-up city approach can be for the innovation and entrepreneurial community. Welcoming new entrepreneurial initiatives which are aiming to solve real market problems combining one or more emerging technologies can produce a positive impact for the city in terms of technology adoption, innovation awareness and socio-economic growth.

5.4 Turin Urban Air Mobility: the start-up case of Immodrone

As mentioned in the previous chapters of this thesis, Turin has designed a smart mobility holistic approach to gather more economies of scope involving different innovation and entrepreneurial players willing to share the innovation journey. The Turin Smart Road initiative has been the first framework in this vein, and it has been followed soon by the Turin urban air mobility initiative. This refers to the creation of pre-authorised testing areas for flying drones, both outdoor and indoor. During the first wave of Covid-19 pandemic the city has launched a campaign named “Torino City Love”, aspiring to call for its innovation partners and offer free resources to the society. One of the champions of this campaign has been a project from the United States called Skypersonic, a solution for sanitizing buildings and confined spaces using drones capable of flying without a pilot. In march 2020 the city joined forces with this US-based start-up and together they have developed a number of projects exploring the opportunities of these special drones. These pilot activities have led to a first-time transatlantic piloting of drones which could be done in Turin thanks to a very modern 5G infrastructure of the city. As illustrated in figure 3 below the pilot of this project was based in Detroit (Michigan, US) while the drone was performing its mission in a public building of Turin.

Figure 3. Turin's Urban Air Mobility initiative



Source: Turin City Lab archive

UAM programmes started to raise the interest of national aviation organizations such as ENAC in Italy, mainly for setting the formal rules and standards of this new type of services. In fact, especially for outdoor drones flights, a strict bundle of rules must be observed in order to guarantee public safety. Drones initiatives in Turin have spanned to environmental projects, like for instance monitoring the status of the city's river, to public parks controlling activities to logistic projects, like for example the urban last mile delivery. Also in this context of urban air mobility start-ups from all over the world have been active to propose experimentation and pilot projects to the municipality. Local drones services companies have also developed, thanks to the innovation attitude of the Polytechnic School and its renowned incubator I3P.

During his PhD journey the author has been involved as advisor to the CEO for Immodrone, one of the local urban air mobility companies. Born as a marketplace for pilots, embracing a sharing

economy paradigm in which drone-based business to business services could be offered without owning drones, but simply by connecting demand and offer through a dedicated platform, Immodrone started up as a gem into this market and pulled together about 1500 drone pilots in Italy, creating the most comprehensive network able to cover requests by any Italian region. The company engaged also with the Piedmont Region and with the municipality of its capital, mainly focusing on filming destinations and locations for tourism promotion purposes. With fast continuous innovation on automatic flying capabilities, pushed by emerging technologies like artificial intelligence, the role of pilots in drone services seems to decline. For this reason Immodrone opened up an AI for drones division focused on the development of bespoke technology to automate drone services in fields such as infrastructure monitoring, in which the costs and the risks related to humans involved in dangerous operations are still high. The intersection between drones and connected vehicles is also a new and emerging market opportunity. Turin Smart Road and urban air mobility dimensions can converge when for example a drone can identify a road blocking event and immediately inform a connected vehicle for a new routing of its itinerary. The same could happen with taxi drones in the near future. In this context Turin seems uniquely positioned to capture the competitive advantage of its innovation journey towards the attraction of more start-ups willing to develop their new products in a start-up city environment.

5.5 Turin Space mobility: the start-up case of Cosmodity

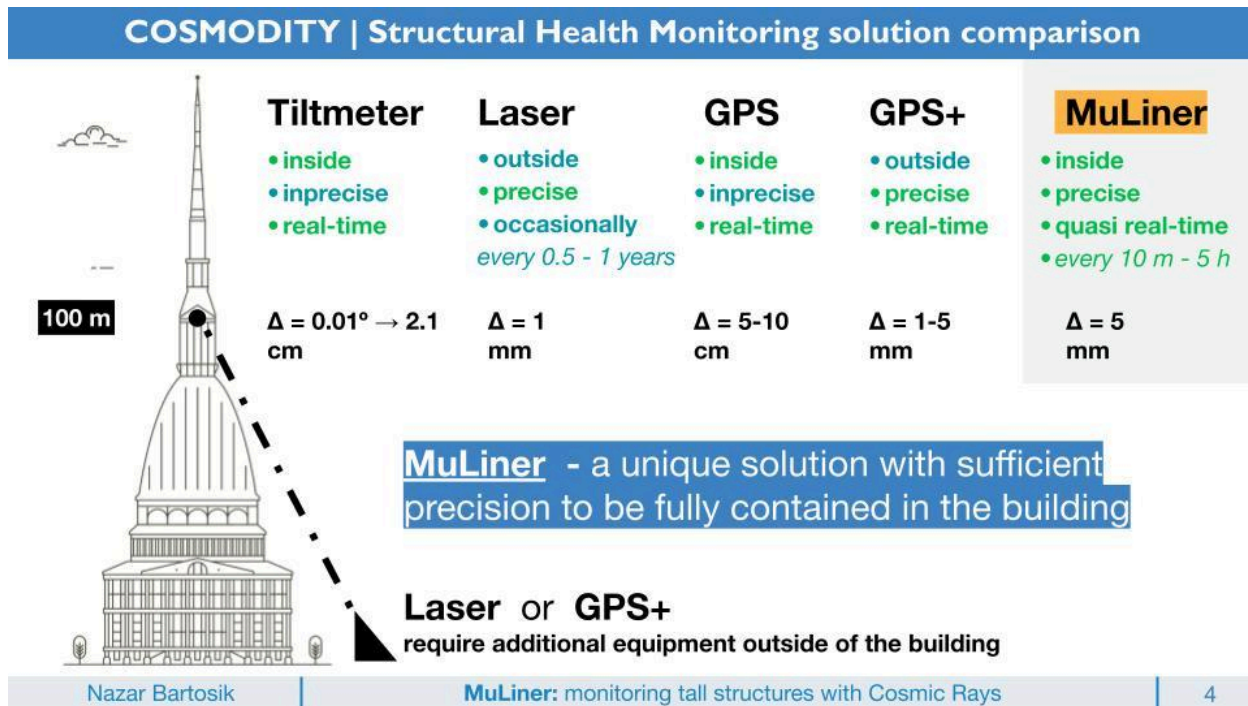
The European Space Agency has partnered with key actors of the Turin City Lab ecosystem, such as the Polytechnic of Turin, LINKS foundation and I3P, to launch its acceleration programme ESA BIC. This initiative searches for start-ups willing to develop a space mobility and space economy new product or service and having the merit of being unique. Such investment happens in one of the most important districts for space mobility in Italy, thanks to the presence of well established companies like Thales Alenia and Leonardo, which are leaders in research and developments in their fields. Furthermore, the holistic vision of a vertically integrated mobility prized Turin for proposing a backbone of enabling technologies to support connected and autonomous vehicles, drones and satellites. This approach showed a circularity implication in practice since data and insights generated at various levels of the smart mobility value chain could be shared among the companies participating in this holistic innovation path.

In this context investors and space economy stakeholders from all around Europe started to monitor closely what was happening in the city of Turin, with the intention of gauging the ambitions of a territory to become a “city of aerospace” and attract top talents from other cities.

A very interesting example of circular innovation newly born in the Turin start-up context is a company named Cosmodity, whose ambition is to transform a commodity such as cosmic rays into a powerful tool to monitor tall buildings' health. As represented in figure 4 below the company has plans to prove the concept of a system able to capture cosmic rays and use them as straight lines to enable a constant real time monitoring of a building's structural condition. The start-up idea comes out of a unique research developed at the Italian Institute of Nuclear Physics in Turin, in which muons, i.e. cosmic rays, are studied and measured in different forms.

During his PhD journey the author has contributed to the pre start-up phase of this company and consequently he became a founder.

Figure 4: Cosmodity Structural Health Monitoring applied to Mole Antonelliana in Turin



Source: Cosmodity archive

Figure 4 compares different structural health monitoring solutions available in the market and MuLiner, a new monitoring tool developed by Cosmodity to provide lean, precise and quasi real time structural monitoring for tall buildings using cosmic rays as straight lines.

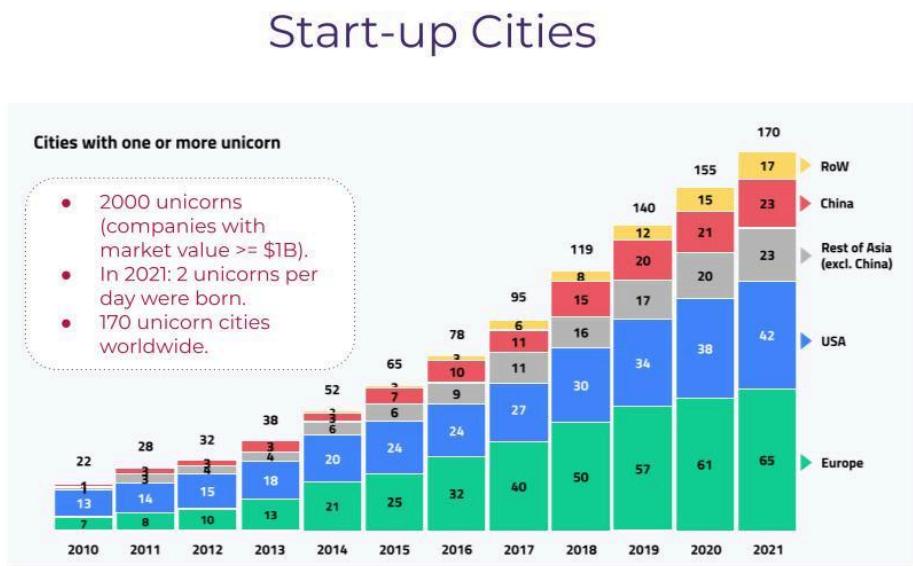
The space mobility sector represents a breed of new opportunities for Turin’s innovation and entrepreneurial ecosystem as well as for the city itself, in terms of new investment attractions and talent circulation. It is expected, in fact, that the space economy will be a key driver for growth in the coming years and its impact can unlock competitive opportunities for those areas able to build a solid

value chain based on this segment. Turin seems to have both the industrial heritage and the start-up city culture to avail of this driver and strongly benefit from it.

5.6 From start-up city to unicorn city

In 2022 Italy reported 230 acceleration programmes running along the year, with a total involvement of about 1600 people working behind the scene to support 3600 start-ups, whose turnover was approximately Eur 350 millions (Social Innovation Monitor - Polytechnic of Turin, 2021). In the same period, at global scale, the top 20 innovation ecosystems have reportedly generated 540 start-ups worth more than one billion dollars each, these companies are also referred as unicorn companies due to their high valuations. As shown in figure 5 there are about 170 cities in the world who host at least one of these companies.

Figure 5: Start-up cities in the world



Source: Startup Genome Report, 2022

Considering an overall count of 2000 unicorns, this number is growing at an average of 2 high capitalized companies' births per day. Based on these data, Europe is home to the majority of start-up cities with 65 locations, followed by the US with 42. While distribution of this population has an impact in this chart it is worth noting that although Europe is able to attract only one fifth of the global venture capital investments in start-ups, it has a solid base of cities who have already demonstrated their attitude to be home of big tech companies, therefore to become potentially start-up cities. Even though Turin is not yet on this radar, in this thesis the author has discussed a number of factors which could enable the growth in the ranking for the metropolitan city of Piedmont. Such key drivers could be summarized in the captive innovation and entrepreneurial ecosystem developed within the Turin City Lab initiative; the circularity of the smart mobility framework involving smart road, air and space mobility innovators; the growing presence of international start-up players like founders, accelerators and investors. The potential benefits in becoming home of a unicorn company may reside in the potential new investments both in tangible and intangible infrastructures, in the competitiveness of the city and its ability to attract talents, in the overall improvement of the emerging technology adoption rate pace by the society.

5.7 Summary

This chapter discusses the rationale behind the start-up city trajectory of Turin, using the lenses of its holistic smart mobility framework and its open innovation participatory ecosystem as main drivers. During his PhD journey the author has got the opportunity to learn from the inside the smart city strategy and policy, moreover he has been an active innovation and entrepreneurial contributor to the city's scene becoming founder of two new start-ups, Plasy and Cosmodity, and contributing as advisor

to the CEO to the development of an established company in the urban air mobility space, Immodrone. Chapter 5 highlights also the opportunity for the start-up city to become a unicorn city in the near future, this showing to be able to nurture a start-up worth more than one billion dollars.

Theoretical and managerial implications

Chapter six

6.1 Introduction

The present chapter discusses the key insights of the whole PhD paper collection journey from a theoretical, managerial and policymaking perspective.

The thirteen scientific outputs present the transformation of a city as a start-up city in the context of a circular economy, providing different scenarios. It is explained by the logic of the microfoundation and Quintuple Helix Innovation System by Carayannis et al. (2022). On this basis, new perspectives are offered from which the following implications are proposed:

6.2 Theoretical implications

Starting from the theoretical framework which is a combination of two fundamental approaches: microfoundation and Quintuple Helix Innovation System, the research journey suggests a new theoretical model to analyze the micro, meso and macro scenarios. It includes a bottom up approach, commencing from a citizens and entrepreneurs' engagement to start-up city level and its entrepreneurial ecosystem in the circular economy (see figure 2, chapter 3). In this middle (the meso level), it refers to sustainable and circular business models and open innovation participatory ecosystem. The latter model is new and original and shows the great involvement of territorial

stakeholders and engagement with city initiatives. This is presented by the case study of Turin City Lab and Home of Emerging Technologies.

The model of Felin et al. (2012) is adapted to the modern age and extended, including the involvement of big players such as public-private institutions; universities and research centers and governments, moving towards the new trend of research based on green talents and global cities. The author firmly supports previous works of entrepreneurial city and start-up city which highlight its incredible potentialities of nurturing new entrepreneurs and offering them new opportunities (Acs et al., 2017; Audretsch et al., 2015). As Schumpeter (1934) described an entrepreneur as one who exploits new opportunities and introduces new innovations. This is reflected not just in an individual but also in a city which becomes the hub for entrepreneurs. Each city should be enriched by a continuous renewal of intellectual capital in the form of human, institutional, environmental, structural and social capital in order to increase the chance of success (Dameri & Ricciardi, 2015). In turn, it induces the relevance of human centrality (Konno & Schillaci, 2020) and recalls the variety of intellectual capital even in the use of the new emerging technologies such as artificial intelligences, augmented reality, internet of things, among others (Bogoviz, 2020). In doing so, the need for network-based organization is emphasized as cities generate more partnerships with other national and international cities, universities and industries (Makecki, 2018; Singh et al., 2020). Keeping this in mind, the Author proposes the open innovation participatory ecosystem which calls for the situational and the transformational mechanism (see Conference paper one, 2020). This model was enlarged considering the work of Carayannis et al. (2022) which describes such collaborations in a form of a helix that assume a dimension of triple, quadruple and quintuple. The crucial aspect regards the increasing relevance of green behavior and intangible assets which are reflected in Conference paper five (2023), Paper one (2022), Paper two (2023), Conference paper six (2023). The role of the green economy is well recognised along with the human being approach (Del Giudice et al., 2023). If from one side, the Author explicates the growth of

the industry 4.0 (see Conference paper three, 2022); Book Chapter two, 2022), on the other side, he acknowledges the great potential stems from individuals which could be entrepreneur, citizens, and customers (see Book One, 2021; Conference paper two, 2021; Paper three, 2023; Paper one, 2022). He debates the new economy known as Society 5.0 (Del Giudice et al., 2022; Del Giudice et al., 2023; Konno & Schillaci, 2021), where citizens are innovators and co-participate in the decision making process of a city which is framed as “start-up urbanism” (Rossi & Di Bella, 2017). The governance model of a city moves from a centralized to decentralized approach. As Adler and Florida (2021) affirm that the new urban innovations have shifted cities also in a set for technological advancements where entrepreneurs can exploit opportunities (see book chapter three, 2023). Technologies are becoming fundamental for such development and in particular, the use of artificial intelligence, digital and mobile platforms are discussed by case studies that introduce the concept of Turin as a prototype of Start-up city driven by smart mobility. For instance, Skypersonic have brought up new technologies in the space drone operations during the pandemic; Local Motors (Olli) has experimented autonomous driving for urban mobility, Immodrone have performed in the urban air mobility, offering 360° vision of city, and the mobile app urban recycling App Junker has promoted the recycling behavior to be a better sustainable city. These case studies and others are complemented by some real companies which the Author has developed during his PhD journey: one in the smart road context, Plasy, one in the space economy context, Cosmodity.

6.3 Managerial contributions

This thesis has been focusing on the role of start-up cities in the circular economy era and the elements of discussions proposed by the author, along with his managerial and entrepreneurial

personal experience, can offer a series of valuable contributions as far as the opportunity of joining an innovation and entrepreneurial city's ecosystem; the reasons why one should apply for an acceleration programme and engage with the municipality and finally what to consider to found a start-up in the city. Furthermore the author can suggest a parallelism between one of the research outcomes mentioned in chapter 4 (paper two) and the managerial impact of intellectual capital in terms of the key role this dimension can play to support entrepreneurship. Thus a start-up city can avail of inflowing talents supporting the growth of a vibrant urban entrepreneurship platform, while founders and start-up teams can fertilize the entrepreneurial ecosystem of the city with their intellectual capital contribution, generating positive effects beyond the number of new start-ups in the city. For instance the human capital and the social capital components of the city's ecosystem could be augmented thanks to a start-up city policy, with the benefit of strengthening the entrepreneurial friendly context of the city and its ranking in the global perception of start-up entrepreneurs. Such managerial implications induce new reflections on specific themes which are discussed as follows:

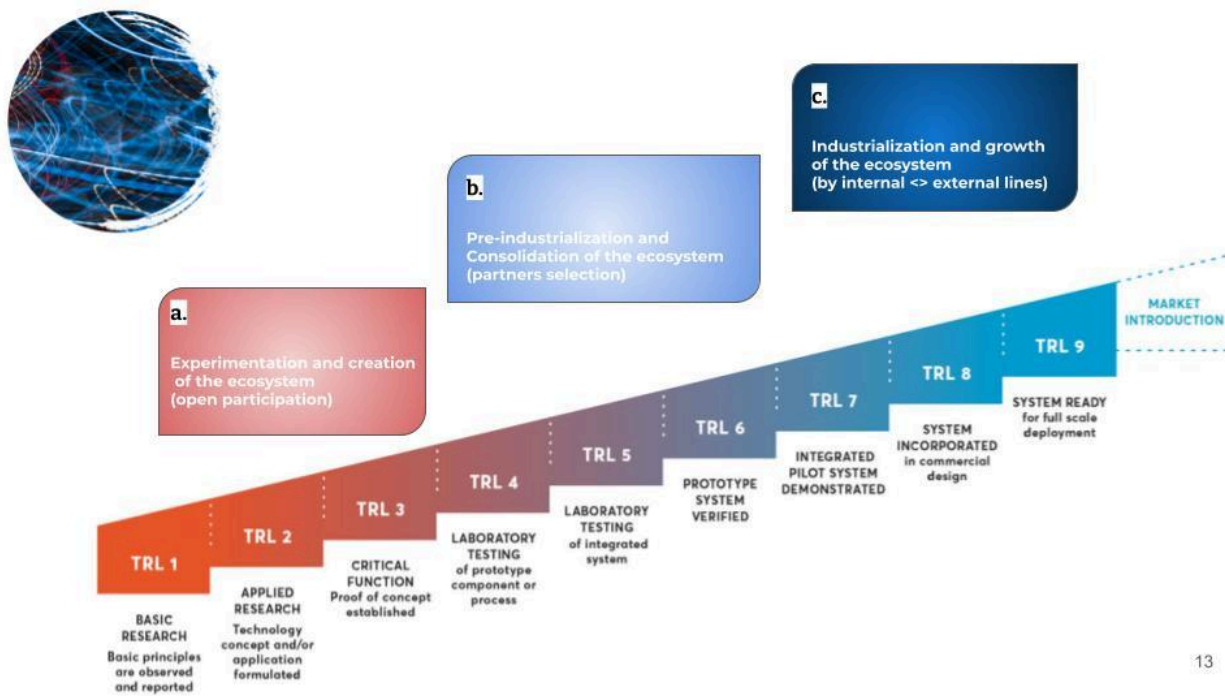
6.3.1 Open innovation participatory ecosystem

In the previous chapters of this work, the author has mentioned the impacts of Turin's open innovation participative ecosystem for the city's partners. When the Turin City Lab platform has been launched, in fact, companies with different backgrounds have been invited to join, one by one, through a dedicated interview and assessment. Although no fee was ever contemplated in this network, the partners of the city had to agree on simple but very important rules: they should have committed to deliver value in one or more innovation processes and help the city stay up-to-date with emerging technologies. This statement has proven solid to appeal to the research and industrial community beyond the Piedmont Region, both nationally and internationally. One of the main reasons has implications in the

technology readiness level strategy, as shown in figure 1. When a city encourages a public - private collaboration on innovation, in fact, it should explicitly share the technology readiness levels in which the ecosystem of partners should contribute. As from the picture below, the city of Turin has opted for three stages of contribution:

- a. An experimentation stage of the innovation maturity, which could involve openly any ecosystem member with the aim of leveraging research and industrial actors' participation to the process;
- b. a pre-industrialization stage of the innovation, in which only a selected and limited number of partners could add value and impact to the process;
- c. an industrialization stage of the innovation process, in which both limited ecosystem contributors could be involved, as well as some external highly qualified new partners could be searched.

Figure 1: Public - private open innovation collaboration framework



Source: Torino City Lab archive

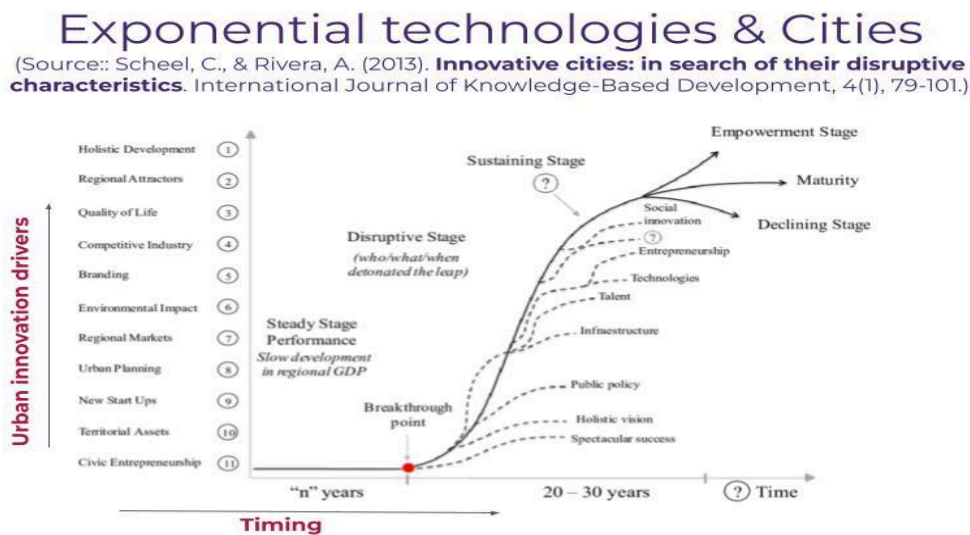
The open innovation participatory ecosystem described and mentioned in this work represents a tangible example of managerial and entrepreneurial contribution. In fact it allowed the creation of a city's innovation ecosystem made of around one hundred organizations, just in less than two years, allowing them to de-risk their research and development process by joining forces with a public-private initiative led by the city itself. Thanks to the open innovation paradigm then, the search for economies of scope along the innovation creation process has been simplified for those small and medium companies and even start-ups who belonged or joined the ecosystem of Turin. This approach allowed for participation in the innovation creation process achieving savings in the resources smaller companies should put into the innovation journey thanks to the open collaboration with peers. Moreover thanks to the experimental friendly urban launchpad of the city, companies could have a preferred test ground for their prototypes and innovative products and services. A manager or entrepreneur looking at further efficiency in the innovation process of his company, or interested about an emerging technology to be capitalized for its company's purposes, should carefully look at opportunities of joining such open innovation participatory ecosystems. These circumstances tend to be found in those cities who understand the importance of developing a strong and diverse innovation ecosystem and also look at more start-ups to come and play in their urban testing areas.

6.3.2 City acceleration of a start-up

Acknowledging the growing trend of innovation acceleration at global scale, the author, who personally participated as entrepreneur and also as mentor and advisor to those programs, discussed the role of the start-up acceleration programs which have been launched in the city of Turin. According to the feedback provided by attendants of the Techstars acceleration programs 2021-2022

held in Turin, a city can accelerate a start-up journey. In the context of this thesis this assumption can provide support to the idea of start-up cities as new models for the cities of the future. While cities need more start-ups around them to accelerate and support their emerging technology adoption rate, if start-ups can be accelerated by cities in their efforts to find product-market fit, this circular innovation effect can become virtuous. In chapter 5 the author has mentioned about the fast growing trend of acceleration programs at global scale as a consequence of cities willing to become more competitive to attract talents and new technology companies. While scholars have been searching and modeling the drivers of innovative cities for a long time (Scheel et. al, 2013) managers and entrepreneurs have been focusing on the role of cities as catalyzers of innovation more recently, notwithstanding the presence of new start-up attraction among the city innovation drivers for a decade.

Figure 2. Innovative cities in search of their disruptive characteristics



Source: Scheel & Rivera, 2013

Thanks to the growing presence of world class acceleration programs in many cities in the world, the innovation and entrepreneurial ecosystems of those cities can gain from the contamination that the

breed of new start-up can bring to the local context. In the case of Turin, the city has been an initial sponsor for the creation of tailored acceleration programs which could impact the local class of innovators with international best practices. Some of the foreign start-ups attending these programs decided to stay in the city after the class, becoming a new actor of the city's ecosystem and sharing their knowledge with local managers and entrepreneurs. The impacts of foreign companies deciding to open a new branch in the city they choose to attend their acceleration program can be observed with different lenses. For instance an economic lens could suggest that those companies could contribute to the local value production in terms of gross domestic product of the region. A social impact lens could suggest that those start-ups could look for talents locally, thus supporting job demand. An innovation lens could provide some valuable insights in terms of the contribution of this team of talents into the acceleration of the emerging technology adoption rate by the local community. This would also call for an intellectual capital lens to acknowledge the managerial contributions of human-structural-relational capital which can bring to the innovation and entrepreneurial ecosystem of the city. As aforementioned, cities can count on the human and relational contributions of the global start-up community by means of creating an attractive and favorable urban context for allowing technology ventures to flourish.

6.3.3 New organizational forms

Technology start-ups tend to follow new organizational forms as they have proven faster in the adoption of the remote work paradigm. It is common that when a start-up attends a city acceleration program, for instance, only a portion of the team will move physically while the rest of the team will support the acceleration process remotely. Owing to the possibility of building new dynamic

organizations who use emerging technologies to build new products and services, managers and entrepreneurs find it common nowadays to work and interact with colleagues who are based in different parts of the world. The impacts of new organizational forms of start-up companies can bring multiple benefits to the innovation community of a city. For instance a start-up willing to develop a project with a city will not need to relocate completely the team into this city, rather it will be able to start the project lean and efficiently having one person of the team in the city, for engaging with the local municipalities and the city ecosystem, while the rest of the team can support from remote. This scenario is quite common for companies attending the Turin acceleration programs. Local public servants, managers and entrepreneurs can thus engage with the contact person of the foreign start-up and explore new opportunities while expanding their international network. International talent circulation is also fostered by new forms of organizations. In fact, based on the skills required by the project with the city, different people working with the start-up can travel to the city when needed and exchange knowledge with the local research and business community.

6.4 Smart city policy implications

The concept of start-up city discussed in this thesis can have a significant impact in the smart city policies which will shape the cities of the future. As we have seen in the previous chapters, there are at least 170 cities in the world which are looking at their future by investing in start-up attractions. Those cities are trying to compete with each other leveraging different innovation drivers to be perceived as start-up friendly lands. While the most important world innovation ecosystems tend to show a solid advantage in terms of entrepreneurial maturity, we can observe some new ecosystems coming from

emerging countries which are rapidly evolving their smart city strategy. Based on the author's discussion and publications, at least three key smart city policy implications can be mentioned:

1. Public employees working for the city should be trained to fully understand the implications of emerging technologies and their impact for the local communities;
2. city 's managers and entrepreneurs ecosystem should be stimulated to actively participate in the innovation processes raised by the start-ups attending city acceleration programs;
3. New trans-city knowledge sharing platforms shall be implemented in order to share data and insights from urban testing and experimentations.

This work has been inspired by the author's experience of both innovation leaders in a metropolitan city of Italy as well as of start-up entrepreneurs in the same context. The combination of these unique experiences provided insights about a new model of city for the future, a city able to learn from start-ups and gain from attracting as many as possible in order to increase its capacity of adopting emerging technologies. Policy makers and smart city experts can find in this research work some new interesting stimulus for designing new smart city policies towards the discovery of new models for the cities of the future. The start-up city is a candidate to become one of those.

6.5 Summary

The present chapter highlights the theoretical and managerial implications which can be summarized in 1) offering a new theoretical framework which combines microfoundation and quintuple innovation helix; 2) enlarging the literature on start-up cities and innovation ecosystem along with entrepreneurship; 3) introducing new model as the open innovation participatory ecosystem model; 4) presenting some real case studies which inspire new best practices and further research; 5) new smart city policy implications.

Conclusions

Chapter seven

7.1 Introduction

The present final chapter summarized the key original contributions of the PhD collection paper which expresses a clear singularity in his form and value. This PhD journey demonstrated an intensive theoretical and managerial development, framing a new theoretical framework and founding two new companies.

The Author was extremely engaged within the PhD programme that he felt stimulating in bringing up a new theoretical model and new companies which translate the theories in practice. The discussion of thirteen scientific works describes the PhD journey and valorize its scientific outputs, originated by the international and national collaborations with esteemed top scholars such as Manlio Del Giudice, David Ricketts, Amandeep Dhir, among others. This has enriched and nurtured knowledge on innovation, technological advancements, smart mobility, and start cities along with knowledge management.

In turn, it reflects in his theoretical advancement which mainly conveys the new theoretical framework as a nexus of the microfoundation theory and the quintuple innovation helix along with the social impact. It is interesting to note the evolution starting from action formation stage to situation and transformational mechanism which moves from a micro, meso and macro scenario, including entrepreneurs' and citizens' engagement, sustainable and circular business models, open innovation participatory ecosystem, sustainable and entrepreneurial ecosystem and start-up city. This is also framed in an ecosystemic view of the circular economy scenario which involves the participation of government, universities, research centers, and public and private institutions.

On a managerial side, the PhD journey is also characterized by the establishment of two companies in the smart cities realm. It is particularly interesting that the author was involved in the foundation and contribution to a number of start-up initiatives in Turin while progressing on his PhD journey. The vision of a start-up city has been exploited in multiple dimensions as an entrepreneur with the contribution to the establishment of two new high potential start-ups: one in the smart mobility field, namely Plasy, and another one in the space mobility one, known as Cosmodity. Moreover, the author has been involved as entrepreneur in residence for the city acceleration programme Techstars. In this endeavor his contribution has been to foster Turin's start-up ecosystem by supporting the companies selected by the acceleration programme in the development of validation projects with the municipality. Over a period of three years, corresponding with his PhD commitment, the author has contributed to approximately forty proof of concept projects with the city of Turin. In a retrospective overview of the PhD journey by the author, it is relevant to note the growing position of the innovation ecosystem of Turin in the Startup Genome international ranking. One of the main drivers of this ascend is represented by the stimulus provided by the local institutions and the Turin City Lab partners to the attraction and retention of international startups. The author has provided valuable contributions to these joint efforts, at first as head of the innovation team of the city in the period 2019-2021, then as entrepreneur in residence for Techstars city acceleration programme in the period 2022-2023, further as entrepreneur with the creation of two new start-ups offering smart cities innovative solutions and finally as mentor of many other teams who have been attracted. It is also worth mentioning the relevance of the author's PhD research to provide theoretical and managerial explanations and rationale to the role of Turin as a prototype of start-up city, through the lenses of the new theoretical framework which conveys the microfoundation theory and the quintuple innovation helix along with the social impact innovation.

7.2 Conclusions, main limitations and future direction of research

The cities where we live are of paramount importance in our lives, thus we should all try our best to be involved in their developments and improvements as more competitive places with better quality of life, better working opportunities and higher sustainability. Cities have the possibility to lead the impact of emerging technologies in their citizens' lives, by incorporating those technological advancements in their service offering and their processes. In this research the author has discussed the opportunity for cities to center their innovation strategy in the creation of start-up friendly ecosystems in order to improve their capacity of adoption of emerging and disruptive technologies, thus achieving higher competitive, sustainability and social impact goals.

The emerging approach characterizing the phenomenon of the human centric innovation, also known as industry 5.0, is suggesting to base innovation strategies considering holistically other domains than only technology, such as sociology and philosophy for instance. Hence Cities of the future should consider to adopt a smart city policy able to convey an multidisciplinary and holistic approach to emerging technologies and urban developments, thus granting a better trade off between the complexity of technological leaps and the capacity of adoption of disruptive innovations of the community, considered here broadly as an expression of the quintuple helix stakeholders groups: citizens, local authorities, enterprises, universities and media. Furthermore, owing to the fact that human beings have proven to be faster and more exponential in adopting emerging technologies, Cities of the future should consider embracing such potential holistic approaches when designing their innovation and development strategies.

Some key limitations of this research should be further considered in order to tackle and improve the following aspects:

i) notwithstanding the author's effort to provide a wide and comprehensive analysis and consideration of different urban innovation ecosystems, there is a limited exploration of cities ecosystems to apply both theoretical and managerial considerations;

ii) the present research is widely based on the overall the number of publications that the author has developed over three year period of PhD, thus limiting by design the broader consideration of theoretical and managerial aspects of this realm;

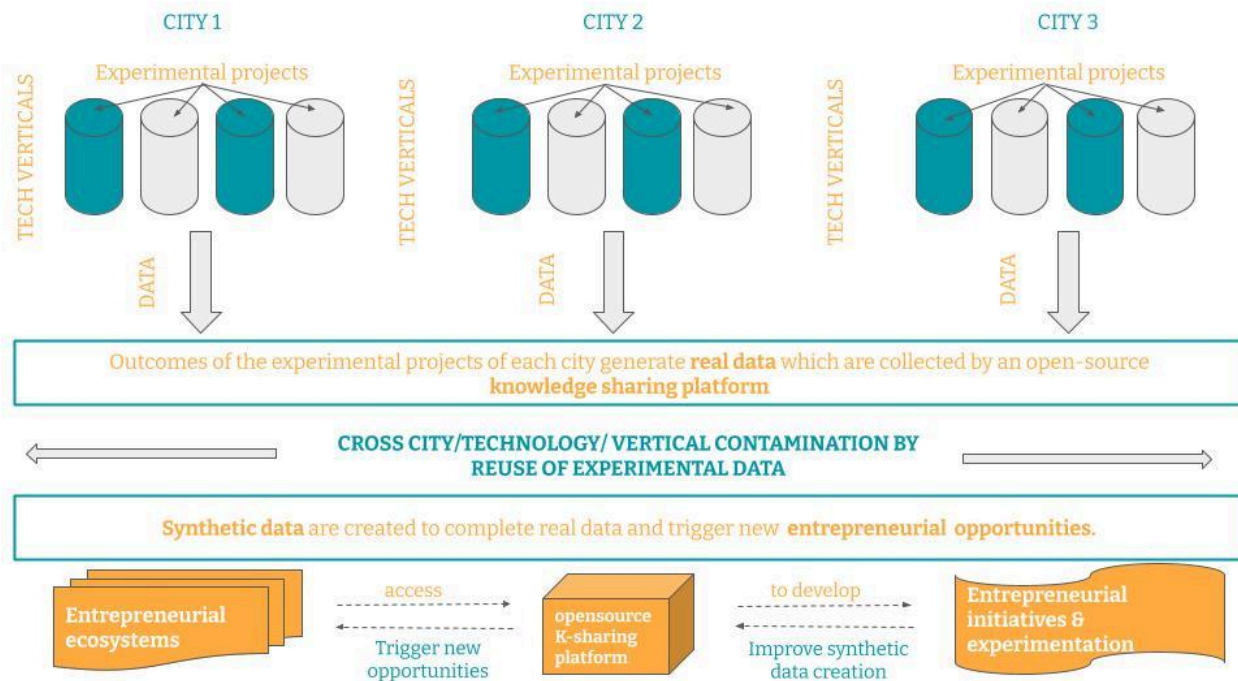
and finally

iii) the author has focused the case study of Turin as a prototype of start-up city due to the theoretical and practical direct experience he could gain in five years of involvement with the local innovation and entrepreneurial ecosystem, as well as with the local authorities such as the City of Turin and its innovation agencies. Therefore the limited international focus of the start-up city scenario provided could be improved when extending the scope to consider other cities in different geographies and maturity stages.

However, some potential future direction of research may also employ the exploration of some specific technologies such as artificial intelligence in the acceleration of a cross-city platform for allowing cities to exchange more actionable data and insights about their start-up communities.

For instance, in the research model presented below (figure 1), the author intends to provide an input to a potential future direction of research by considering the role of a knowledge sharing data platform in the propagation of start-ups in multiple cities. In fact, thanks to urban experimentations which are creating a high volume of real data, emerging technologies like artificial intelligence could be employed to analyze and distill entrepreneurial opportunities from those data, and automatically filling dataset gaps by means of synthetic data created on purpose by an artificial intelligence agent.

Figure 1: high level model of an open-source cross-city knowledge sharing platform powered by artificial intelligence.



Source: Author's elaboration

In turn, further exploration could be addressed to the creation and use of synthetic data to fill the knowledge gaps between municipalities and their innovation ecosystems and start-up communities. In this vein, knowledge sharing could happen at higher speed and cross-city fertilization could provide a significant acceleration to the ecosystem growth, nurturing new groups of entrepreneurs. The vision of the author about this potential direction of research has implications in the open source philosophy, due to his current experience in this domain with a new start-up named W4 Games. It is believed that a great potential of innovation is still laying unexplored because of cities not leveraging on peers data and insights due to a lack of knowledge sharing infrastructure which could be unlocking further

opportunities, while also representing a circular innovation model across cities. The great effort is made to deliver a fantastic PhD collection journey which reflects on a consistent number of publications, knowledge dissemination and starting new business ideas which are prominent in making new impact in the society and overall in the whole entrepreneurial and innovation ecosystem.

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