FOREWORD

«*Considerate la vostra semenza: fatti non foste a viver come bruti ma per seguir virtute e canoscenza*»

Dante, *Divina Commedia*, Canto V Inferno

While I was finally writing the last paragraphs of this book, one of my kids asked me what I was doing. "I am writing a book," was my reply. As curious as any 5-year-old kid, this reply was not enough for him. "What is this book about?" he asked. I did not know how detailed my answers could be for him to understand anything about knowledge management and digital technologies. "It is about knowledge and technology," I tried. He pressed: "What has technology got to do with knowledge?" It was clear that the debate had just begun. "Uhm, let's see" – I tried to buy some time – "sometimes the technology can help in finding new knowledge." He thought a bit and then said "Ah, it is like a robot who knows someone and recognizes who knows someone. Or, a telephone that knows someone's password." It made me smile. At first, I did not understand what he meant. I tried to deepen the conversation and I got it. For him, technology and people go hand in hand, and there must be something useful in this relation.

Actually, I believe that he is not far from the essence of knowledge management. We are living in a world of Information and Knowledge. These years will be remembered as the Knowledge Age. And yet Wisdom is a foremost prize that we human beings tend to seize. In an era when sources of data are diffused, quantity of data available is massive, information seems to be widespread and innovation is spreading at an unprecedented speed, it has become crucial to distinguish between valuable and ignorable data, between trustworthy and unreliable sources of information. Now that information overload is a tangible threat to our productivity, attention has become a significant success factor for individuals, as well as for organizations. In this complex world of big data and Information and Communication Technologies, we humans have become acquainted to interacting with non-human artefacts. We refer to the youngest generations as the native digital. Indeed, my youngest child, who at this time is not even one, fights with his siblings to hold my smartphone and stares at its screen turning on and off. The interactions between humans and ICT have be-

come a familiar habit, almost natural, and probably continuous. While we unconsciously use such non-humans artefacts, we leave behind a digital footprint, which is far more interesting than the digital fingerprint. While retrieving data, we produce new data. It may be worthy to understand the path that leads from those data to knowledge, and which kind of knowledge. At an organizational level, businesses have started to embrace the digital revolution in a variety of ways. Not always following a planned strategy, contemporary organizations have been forced to deal with the digital disruption. Also, exponential technologies are paired with exponential organizations, but the average company is probably unaware of how to exploit the full potential of the digital technologies and to convey proper knowledge-creation processes.

Recently, the whole world has been in lockdown to overcome the Covid-19 pandemic. Digital Technologies have been necessary to continue normal daily activities such as working, attending schools and universities, and meeting family and friends. Knowledge sharing and creation have increasingly been intermediated by digital technologies, such as video conferencing platforms, shared documents, and distant learning solutions. Whether this experience has left us wiser is difficult to assess. Nonetheless, the pandemic emergency has opened Pandora's box showing the shortfalls of massive usage of digital technologies. This unique social experiment has, among other things, revealed the flaws of a digitally interconnected – and always connected – world. We, as humans, experience the limit of human brains in terms of computational capacity, memory, and speed. Digital technology, on the contrary, is fast, ubiquitous, and capable of massive quantities of data. But when it comes to knowledge and wisdom, technology alone is not the solution. I believe that Ulysses' words are still valid. In the Divine Comedy, Dante makes Ulysses warn his companions: "You were not made to live like beasts, but to follow virtue and knowledge." Undoubtedly, it is in our human nature to aspire to know more and do better. To achieve this goal, digital technology can be a great help. But brutally using technology would leave us in the dark living like modern, digital, connected... beasts.

My interest for a Knowledge-based Economy traces back to my very first professional experience, working first for a telecommunication company, and completing my PhD in Organizations and Information Systems. At that time, we were at the dawn of this completely new way of organizing the global economy. Fifteen years later, disruptive and massive digital technologies have brought radical changes in the world economy. The Information Economy has become reality, and the Knowledge-based perspective of firms is nowadays mature. The fourth Industrial Revolution has imposed new challenges

on firms and on the ways in which people interact, produce, and organize their lives and the whole economy. Yet the dynamics of knowledge creation, both at individual and organizational levels, deserve scrutiny and research.

This work is the result of the interaction between myself and the brilliant colleagues and students whom I have encountered so far in my professional life. My friend and colleague Michela Marchiori has taught me the value of rigorous research paired with a critical approach, while at the same time practicing the immense art of working together respectfully.

I am thankful to all the students who accepted to engage in the nontraditional, interactive, and highly demanding courses that I teach. I deeply believe that learning only comes through continuous interaction and knowledge sharing, and I try to put this in practice in my courses, asking students to be curious and provocative and always ask questions. The naughtier, the better. From these students I have learnt a lot. Some of their inputs have also fed this book and they are fully credited in the coming chapters. Among the others, I am thankful to Laura Pileggi, Flavia Mozziconi, Valentina Podestà, Sara Pennacchini, and Pietro Pratense, for their feedback and stimulus to be constantly up-to-date. I started teaching very young and I have soon realized that being a teacher is more about learning than passing knowledge, more about receiving than giving. Of this I am extremely grateful to God. Working at Roma Tre University and being hosted as a visiting scholar in prestigious Business Schools gave me the chance to engage in very interesting academic debates that have left me a bit wiser but also much more curious to know more. More than 2400 years ago, Socrates, conscious of human limitations, said: "One thing only I know, and that is that I know nothing." Hopefully, the nothing that I know is clearly illustrated in this book and will provide occasions for further academic debates. The rest that I do not know has probably led me to make some mistakes as well, for which I deeply apologize.

A special thanks is devoted to my family: Matteo, Chiara, Leonardo, Ginevra Anna, Romeo, Margherita, and Adriano, and to my parents, who have been so patient to stand by my side, and who gave me the most valuable stimulus for my job. Being a researcher gives me opportunities to increase my knowledge. Being the wife to a researcher gives me chances to debate my understanding. Being a mom gives me opportunities to be challenged and contested. Hopefully, this will lead to wisdom, eventually.

Lucia Marchegiani

Roma – Italy
May 2020

INTRODUCTION

«On ne reçoit pas la sagesse, il faut la découvrir soi-même après un trajet que personne ne peut faire pour nous, ne peut nous épargner.»

Marcel Proust

For human beings, knowledge has always been a distinctive trait. The quest for more advanced knowledge has motivated human actions over the course of history. As Proust wrote in his masterpiece "*À la recherche du temps perdu*," we [human beings] are not provided with wisdom, we must discover it for ourselves, after a journey through the wilderness which no one else can take for us, an effort which no one can spare us. Nowadays, knowledge is at the core of the socio-economic global system, and unexplored areas of socio-economic development have appeared. For profit and not-for-profit firms, institutions, and organizations in general face unique opportunities and threats related to knowledge. Digital technologies and digital transformation offer a wide array of opportunities for value creation. At the same time, organizations need to foster newer, faster, and more dynamic ways of mobilizing and managing knowledge. In this scenario, knowledge management can be considered as a powerful tool to face the journey through the wilderness that can lead to (organizational) wisdom. The interplay between human and non-human actors in sharing knowledge requires extraordinary organizational change and renewal. Emerging trends, such as artificial intelligence, collective intelligence, agile methodologies, open innovation, and co-creation enable new business models and managerial paradigms that need to be understood and conceptualized.

This book offers an extensive overview of the most recent trends in knowledge management that take into account the interplay between human and non-human actors. It aims at offering an up-to-date conceptualization and guidance for the implementation of knowledge management in an era of unprecedented human/non-human interaction.

This book conveys the results of more than a decade of research and applied experience in the field of knowledge management carried out by the author. It is intended not only for students and academics but also for

managers and practitioners who are interested in deepening their understanding of knowledge and learning in the contemporary economy.

It covers a comprehensive view of the most advanced theoretical approaches while, at the same time, offering a wide array of case studies and evidence-based knowledge management practices.

This book thereby takes up the theoretical debate about knowledge management in light of the most recent technological and managerial advances that support the digital transformation of organizations.

This book offers a broad understanding of the theoretical underpinnings of knowledge management in the digital era while also providing an overview of the interrelation between ICT and knowledge management challenges, in terms of human/non-human interactions.

This integrated perspective combines a theoretical framework with practical solutions and benchmarking. Moreover, in an innovative way, this book adopts a new multi-layered perspective on the organizational implications of the adoption of digital technologies and of the digital transformation.

The work is divided into four chapters. It starts with an overview of the origins and evolutions of the discipline of KM and an understanding of the current challenges. The first sections cover the history of knowledge management, explaining why it has emerged as a stream of research and as a business practice. Moreover, these chapters highlight the current and foreseeable trends related to new needs that emerge from the evolution of business-related technology. Starting from the seminal contributions of Nonaka and Takeuchi, Davenport, Senge and other founding fathers of organizational knowledge and learning, these chapters will cover the more recent contributions that have deepened the understanding of how organizational learning works and what challenges knowledge management poses to contemporary organizations. The concept of non-human knowledge is also introduced here, as well as the interrelation between human and non-human actors in sharing business-related knowledge. These chapters are written adopting a critical perspective in order to provide the readers not only with an academic overview but also to introduce and discuss relevant practice-oriented challenges.

The second chapter aims to answer the question "Why is knowledge the strategic asset?" The sections in this part cover topics that are relevant from a managerial perspective. Well known concepts such as digital transformation and organizational learning are discussed with a new flavor. The lat-

ter is related to the increasing centrality of digital technologies in defining strategic orientation and in guiding organizational decisions. The technologies that are emerging as standards are introduced. The aim of these chapters is not only to provide the students with an overview of these important technologies, but also, and mostly, to discuss how these technologies disrupt the ways in which businesses are managed and organized.

The third chapter focuses on the concept of knowledge and learning organizations. This part deepens the managerial challenges and discusses the toolkits that are available to face the technology related managerial challenges. In particular, these sections adopt an organizational viewpoint and deepen the understanding of the emerging trends in managing organizational learning and knowledge. Again, these sections focus on the new trends of managing human and non-human actors, and their interrelation. Old concepts such as knowledge workers are revisited with a perspective of the new technologies that interact with the human workers.

The fourth chapter focuses on contexts. Although case studies are scattered throughout the whole book, this part is specifically reserved to the discussion of cases that constitute good practices at the operational level. Each case study is related to a specific operation. This provides the readers with a ready-to-use example of how digital technologies have disrupted the operational level of organizations (for profit but also not-for-profit) and what managerial decisions have been adopted in good practices. Moreover, the chapter offers an overview of the evolution of the telecommunication sector through the innovation waves that have disrupted the sector over time. Finally, a specific study is reported, that focuses on how knowledge management practices can overcome the problem of organizational silos, and foster intra-organizational knowledge sharing.

Chapter 1
ORIGINS AND EVOLUTIONS OF KM

SUMMARY: 1.1. Where Do We stand? – 1.1.1. The Internet Revolution, when It All Started. – 1.1.2. The 4th Industrial Revolution. – 1.1.3. The Rise of the Knowledge Economy. – 1.2. Where Do We Go from Here? The Digital Age. – 1.2.1. Innovative Organizing: Tacit and Explicit Knowledge. – 1.2.2. Innovative Organizing: Intermediate and Multi-Sided Markets. – 1.2.3. Innovative Organizing: Networks and Platforms Organizations. – 1.2.4. Innovative Organizing: Mass Collaboration. – 1.3. Evolution of Knowledge in Management. – 1.3.1. Data, Information, Knowledge. – 1.3.2. Approaches to Knowledge Management. – 1.3.3. Network Perspective in Knowledge Management. – 1.4. Why Do We Still Need to Manage Knowledge? – 1.4.1. Knowledge Management and Innovation. – 1.4.2. Knowledge Management and People Management. – 1.4.3. The Pyramid of Knowledge, Revisited. – 1.4.4. Much Ado About Knowledge, Here Comes the Pandemic!

1.1. Where Do We Stand?

We currently live in a world where digital technologies and the Internet play a fundamental role in our daily lives. Technological advancements offer benefits and advantages to us all-be it as individuals, communities, businesses, or organizations-by expanding the boundaries of information availability, enhancing efficiency and agility, and reducing costs.

As a society, we perceive that we are surrounded by constant and rapid technological innovations, especially thanks to our continuous exposure to media. In spite of our perception, and despite living in the so-called Digital Age, the transition to a fully-fledged digital society is not yet complete. The term Digital Transformation has become familiar as one of the most compelling managerial trends. Yet, the organizations that embrace this transformation most of the time underestimate the organizational consequences and the impact on human resources. Generally speaking, the digital transformation requires a profound organizational change that includes, but does not end with, digital information technology. In order to understand this complexity, it is necessary to step back and look at the past decades, when the seeds of the digital age were laid.

Information Technology refers to the technological applications that are developed to drive information and to favor the exchange of information among remotely connected points. The advent of the Internet and electro-

nic settings (e-business, e-commerce, e-marketplaces, etc.) boosted the relevance of information technology, and Information Systems started to be at the center of academic and managerial attention. Those are systems where the different Information-based components are intertwined and integrated. The overall aim of such complex systems is to optimize the exchange of information, selecting the relevant contents, in a connected input-output series of nodes.

1.1.1. The Internet Revolution, when It All Started

In the late '90s, the convergence between Information Technology and Telecommunication gave birth to Information and Communication Technology. The pace of innovation activities dramatically boosted and Moore's law became famous, stating that the power of ICT doubled every second year.

The first notion of Information Age can be traced back to the early '80s, when the advent of more and more refined technological applications for Information processing, alongside with social transformation, gave rise to the idea that a completely new world was about to be born (Naisbitt & Bisesi, 1983). It is interesting to recall the Megatrends of the Information Society that were detected at the end of the 1980s:

1. A clear pattern emerged from the Industrial Society to Information Society;
2. From mechanical relations with Forced Technology to High Tech/High Touch (FAXs that can be touched, cut, pasted, colored, etc.);
3. From a limited National Economy to the broader World Economy;
4. From perspectives based on the Short Term to Long Term views;
5. From a general approach towards Centralization to Decentralization;
6. From the belief on Institutional Help to the emergence of Self-Help;
7. From passive forms of Representative Democracy to more active Participatory Democracy;
8. From Hierarchies to Networking;
9. From a North-centric perspective to South;
10. From the dyad "Either/Or" to Multiple Option.

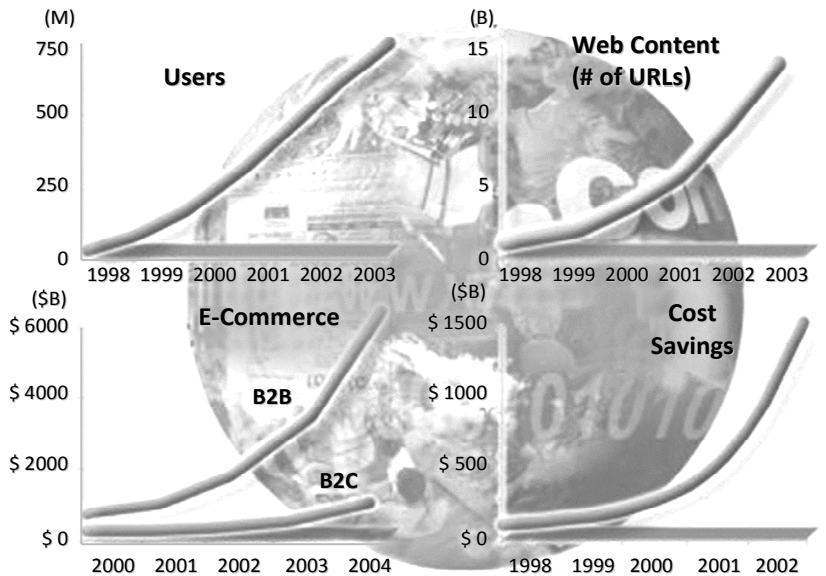
Over twenty years later, these megatrends are still valid. The Interconnected world (Malhotra, 2000; Muegge, 2013) has become indeed a commonly used expression. This impels a deep investigation of what happens in a large complex system of interconnected agents. This kind of society has plenty of consequences, from social life to the economic sphere. From a sociological perspective, it has been said that the whole world has become

smaller, and that distances may have been nullified by the existence of digital highways. A widely appraised author is Manuel Castells, who traced back the origins of the Information Economy to three interrelated processes, namely:

- the IT revolution,
- the fall of capitalism and statism, and
- the rise of new social movements.

According to the Author, together these three processes have caused a new social structure (a network society), a new economy (a global informational economy), and a new culture (a culture of 'real virtuality') (Castells, 1996, 1997, 1998).

Figure 1.1. The rise of the Internet Revolution.



Source: author's elaboration.

The **Internet Revolution** started at the beginning of the 21st century with a boom in informatics, in terms of a rapidly increasing number of Internet users and of web content (Figure 1.1). These changes brought heavy impacts on the economy, but also on society and individual lives. The rise of e-commerce was favored both by an increasing offer through websites and by the users who welcomed this new way of shopping online.

Such a Copernican revolution implied that information flows are at the center of the economic cosmos, instead of the firms' assets and competencies. Information flows are not only internal to firms. Instead, they are ubiquitous, and firms should be able to capture relevant information, where it appears and grows. At a closer look, the revolution laid on technological as well as socio-economic drivers, such as:

- Technology:
  - The diffusion of the Internet, and of high-speed Internet connections;
  - The increasing amount of data available on the World Wide Web;
  - The diffusion of devices such as PC and mobile devices: these are the gateways to access the Internet and WWW and serve multiple purposes, such as typewriters, archives, libraries, post offices, banks, supermarkets, newspapers, weather forecasting, TV, cinemas, games, financial markets, videoconferences.
- Economic drivers:
  - The increasing globalization of markets;
  - The decreasing regulation;
  - The privatization of former public monopolist TLC companies.
- Sociological drivers:
  - New lifestyles;
  - Standardization;
  - The increasing appeal of instant communication.

If the revolution started with technologies that drive information and knowledge, it then became pervasive and caused a radical change, such as:

- The shift from industrial capitalism to cultural capitalism;
- The emergence of a new renaissance, which considers man and technology at the core of the universal values;
- The rise of innovation and creativity: the revolution allowed the reinvention ofgoods and services, new businesses emerged, and e-commerce boomed.

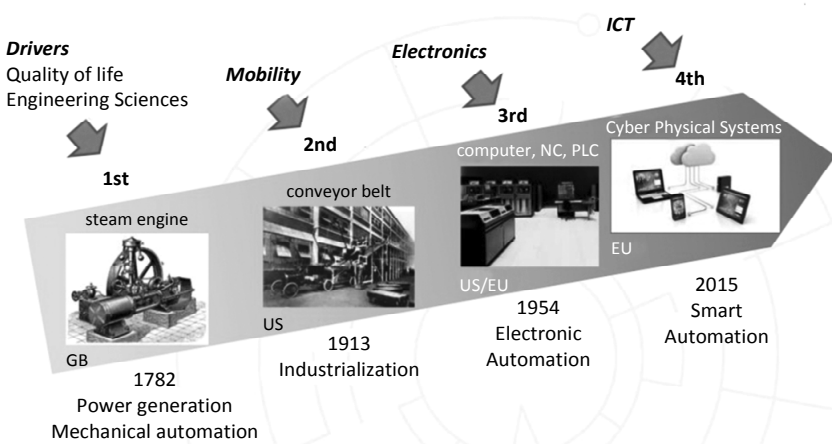
These are the basics of the dawn of the **Digital Age**. With Information becoming one of the strategic assets of firms, a large part of the economics principles has changed. When it comes to understanding the kind of revolution that firms have had to embrace to capture their competitive advantage, it is straightforward that information plays a pivotal role. Nowadays it is meaningless to ponder access to natural resources or scale and

scope economies as sources of competitive advantage. Most of the time what makes the difference is the ability to orchestrate intangible assets, such as knowledge and competencies, and to deploy them over time in what are called dynamic capabilities (Teece, 2007; Teece et al., 1997).

1.1.2. The 4th Industrial Revolution

The Internet Revolution was just a preamble to a wider industrial revolution. In the history of modern economies, this is labeled as the 4th Industrial Revolution (Figure 1.2).

Figure 1.2. The four Industrial Revolutions, over time.



Source: author's elaboration.

The 1st Industrial Revolution, that marked the proto-industrialization period, started at the end of the 18th century to the beginning of the 19th century in Great Britain. Due to mechanical automation, the handicraft model of production converged into a machine model of production, with prevalence in the textile-metallurgical sector and the use of inanimate energy sources such as coal, steam, and waterpower. The invention of the steam engine created a new type of energy that later on also helped to speed up the manufacturing of railroads. The changes that affected the structure of the production system also influenced the economic structure, completely changing the set-up of the social system with the birth of the working class and the expansion of cities.

The 2nd Industrial Revolution occurred between the end of the 19th cen-

tury and the beginning of the 20th century, mainly in the United States. It brought major innovations in transportation, communication, and manufacturing, thanks to advancements in the field of industries that helped the emergence of new sources of energy: electricity, gas, and oil. The production system changed in 1908 when Henry Ford planned the production of cars in bulk due to mass production. In 1913 the process of industrialization took off, with the increasing usage of the conveyor belt and mass manufacturing. The Bessmer process to produce steel and new plastic materials was responsible for the expansion of the rail and telegraph networks, which later culminated in inventions such as the telephone, aircraft, and cars. The increasing interactions of trades, ideas, and people led to a new socio-economic scenario, where mobility started to affirm itself as a societal value. Nonetheless, despite the improved standards of living, unemployment and the social divide increased.

The 3rd Industrial Revolution started in the middle of the 20th century with the rise of electronics, telecommunications, and computers. Through these new technologies, the third industrial revolution opened the doors to space expeditions, research, and biotechnology. Two major inventions, Programmable Logic Controllers (PLCs) and Robots, helped give rise to an era of high-level automation. Also, the first experimentation of digital technologies appeared, leading the way to the Information Age.

What we are currently living in is referred to as the 4th Revolution, although some authors state that we are still living in the long effects of the third revolution. Indeed, we are living a revolution that is completely different from the previous ones, as digital technologies have completely disrupted the old ways of doing business, and the living standards as well. Mechanical or electronic-analogical systems have become obsolete, and digital is now the key. This is the time of the Smart Automation due to fully digital Cyber-physical systems that are central to the development of a Digital Age. For the first time, the world has become fully interconnected, and efficient mobile communication systems have made the world smaller.

Innovative digital technologies (which will be extensively discussed in Chapter Two) are the new enablers of this new phase called the **Digital Age**.

One of the key factors driving the development of the economy in the digital age, also referred to as knowledge-based economy or digital economy, is **data**: a resource which can be fully exploited by means of appropriate analytical tools, and at the same time through a radical change in the organizational culture of businesses and public institutions.

1.1.3. The Rise of the Knowledge Economy

The term Knowledge Economy or Knowledge-based Economy (KBE) emerged with reference to the industrial organization and management dynamics of the knowledge-intensive industries that face the competitive challenges of the 4th Industrial Revolution. Those are economic settings characterized by a high density of knowledge and information. In particular, with the digitalization waves, knowledge became a valuable asset per sè, whereas in the older industrial settings it was included in the products that were commercialized. In other words, the digital waves provoked a dematerialization of the industrial world, raising the relative importance of the service-based industries.

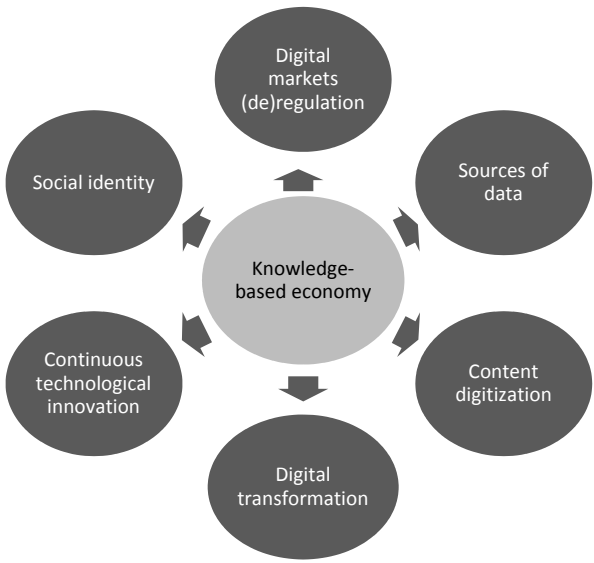
The importance of knowledge and networks of relations for firms' growth processes has received much attention by economists and management researchers. In particular, value-adding processes of firms (such as the internationalization one) are increasingly based on the creation and exploitation of knowledge and of the connections with other economic actors. Thus, the Knowledge-based view of the firms is intrinsically correlated with the Relational view of the firm (Dyer & Singh, 1998; Inkpen & Tsang, 2005; Yli-Renko et al., 2001).

Knowledge-intensive products and services (Bettis & Hitt, 1995; Rylander & Peppard, 2003) and relations (especially external ones), see for example (Zheng, 2010), represent a good vehicle to acquire and combine new knowledge.

In other words, the emphasis of knowledge leads to focus on the ways by which it can be generated or accumulated, taking into consideration the environment where the firms act. In this perspective, relations are one of the principal means through which external knowledge is acquired, which in turn sustains the creation of new, internal know-how (see later par. 1.3.3). How firms are organized, and knowledge is funneled and new knowledge is created is at the basis of the firms' competitive advantage (A.H. Gold et al., 2001; Nahapiet & Ghoshal, 1998).

While there has always been a recognition that managing knowledge is important in organizations, some emergent forces have caused a resurgence in this idea (Figure 1.3). Not only managing knowledge is now recognized as an important strategic issue, but knowledge itself is central in wider debates about the sources of wealth creation in contemporary society and the management of knowledge workers.

Figure 1.3. The determinant of the knowledge-based economy.



Source: author's elaboration.

The knowledge-based Economy has several characteristics, such as:

i) Deregulation of markets;
ii) Increased number of sources of data and information;
iii) Content digitization;
iv) The awareness that a digital transformation is needed for firms to stay competitive;
v) Technological innovations that lowered the costs of information;
vi) The affirmation of a social identity.

For firms, and organizations in general, coping with these characteristics requires embracing a flexible organizational culture and adopting coherent managerial practices. Flexibility, continuous innovation, and agility have become keywords of this new economic landscape.

1.2. Where Do We Go from Here? The Digital Age

The huge development and diffusion of digital technologies has created new business opportunities for companies, making internal processes and organizations more efficient. It has facilitated the emergence of new competitive spaces, on the one hand, and redefined the mode of development