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Diversification strategies in the ICT industry: the TIM case

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Contents

List of Figures

Introduction

"Digital transformation" is one of the most-heard buzzwords of the recent years. Before everyone's eyes, societies are changing at unprecedented speed, as digital technologies become increasingly entrenched in the way we live our lives. Ubiquitous Internet connections, the advent of smartphones and a myriad of new devices, services and technologies opened up possibilities that were not even imaginable just a few years ago. While this process clearly has universal repercussions on consumers of all advanced economies, it is utterly revolutionizing the way business is conducted and in 20 years from now no firm, from the smallest to the largest, will be left unaffected by this process.

Promoting and riding the wave of digital transformation, therefore, are currently at the top of priority agendas of many firms, institutions and governments. The EU, for instance, identifies "fostering digital transformation […] as a priority for unlocking future growth in Europe" and plays an active role in supporting the digitalisation of industries and promoting digital skills and entrepreneurship (EPRS, 2019). Despite the recognized benefits, the transition towards a digital economy brings about considerable challenges, concerning the modernisation of infrastructures, competences and business models.

In the European scenario, Italy is visibly behind schedule, lagging behind most of its European neighbors. In 2018, Italy ranked 19th out of the 28 European States in the EU Digital Technology Integration Index[1], with a score well below the EU average (European Commission, 2018). Furthermore, Italy still needs to bridge the digital divide, i.e. the gap between those who have access to digital technologies and those who are partially or completely excluded from their use. Still, efforts are being made to catch up with the leading countries, both in infrastructural development (e.g. broadband and ultrabroadband connection) and in the adoption of these new technologies by firms and public administrations (e.g. Industry 4.0, Smart Cities, etc.).

While objectives are clear and almost universally shared, many topics are at the heart of the debate concerning digital transformation: Artificial Intelligence, Big Data Analytics, Cybersecurity, Internet of Things, Robotics. However, Cloud Computing arguably plays a pivotal role in this discourse, as the technological paradigm that enables all other technologies and ultimately the digital transformation itself.

[1] The index is constructed as to allow the comparison of the level of digitalisation of different countries

In the Italian context, the ex monopolist and incumbent TIM (formerly Telecom Italia), as market leader in most telecommunications segments, is undeniably one of the most important actors in the digital transformation of the country. The corporation assumes a unique and incomparable position in the ICT industry, because of its long and complex history and evolution throughout an ever-changing environment. As a result, its strategic positioning today is based on assets and competences acquired over the years, and at the same time is affected by changes in the competitive scenario. Therefore, TIM's strategy and position in the Italian market is particularly worthwhile to analyse, both for its relevance in macroeconomic equilibria and for its societal impact in bringing technological innovation and bridging the digital divide.

Since the liberalization of the market in the 1990s, TIM/Telecom Italia's strategy has consistently pursued diversification. From fixed telephony to mobile, from voice to Internet services and from one technology to another, TIM has so far both followed and dictated the path of technological evolution of the telecommunications industry. However, more recently, the group has chosen to diversify in some neighboring industries, and particularly in the Cloud Computing business, building a network of datacenters and becoming a Cloud Service Provider (CSP). Compared to previous diversification choices, this may seem, at first sight, a less obvious move, or at least a choice that it could have just as easily not taken.

For these reasons, this dissertations aims to analyse TIM's diversification strategy in Cloud Computing, as well as its current position, to address the following questions: what are the motivations behind such a choice? What is TIM's potential for success in this new market? What assets and resources can it leverage and what are its shortcomings?

To answer these questions, the analyses encompasses the two different yet similar sectors, and tries to assess TIM's role in them. Chapter 1 examines the Italian telecommunications industry, starting from its historical evolution to then evaluate its current market structure, competitive scenario and latest trends. Chapter 2 focuses on TIM, its diversification strategy and competitive positioning within its core business, i.e. telecommunications. Chapter 3 considers the Italian Cloud Computing sector, from a technological and economic perspective, to evaluate the opportunity it represents for TIM and the challenges it raises. Chapter 4, finally, discusses TIM's diversification strategy in Cloud Computing, by describing its position in the market and then tackling the motivations behind this choice, potential sources of competitive advantage, shortcomings and future prospects.

Chapter 1: The Italian Telecommunications Industry

Throughout the twentieth century and over the last decades, the telecommunications industry has seen one of the most turbulent and fast-paced developments in history. Together with the computer industry, it has shaped our current information-based economy at an unprecedented speed and revolutionized nearly every sector of advanced economies, becoming a fundamental enabler for most businesses. In fact, the link between the development of telecommunication infrastructures in a country and its economic growth is well-established and undeniable (Roller & Waverman, 2001).

Far from being a finished process, the evolution of ICT technologies is continuously creating new markets and destroying others, as new products and services are created and many others become obsolete. Nevertheless, although theatre of disruptive innovations, the ICT industry is also largely based on the establishment of worldwide standards, on network externalities and on massive infrastructural investments. As such, it is subject to path dependency, possibly more so than other industries (Heinrich, 2014)

Therefore, it is crucial to get a glimpse of history in order to gain a better understanding of current scenarios and opportunities in this field. This will serve the purpose not only of providing useful insights on macroeconomic aspects of the telecommunications industry, but also to evaluate the position of the incumbent (Telecom Italia) and its strategic reasoning, both in its core markets (telephony and Internet services) and in the new one under examination in this dissertation, i.e. cloud computing.

The chapter is thus structured as follows: first, a rapid excursus of historical developments is addressed in order to appreciate how the industry developed to be as it is today; second, some general considerations are drawn on the nature of the industry, based on its structural features and its history; third, the current scenario of the Italian market is analyzed at an aggregate level, to identify relevant trends as well as the opportunities and threats they entail for firms operating in the industry.

1.1 Historical background of the Italian telecommunications industry

Without claiming to give an extended account of the history of the Italian telecommunication sector, this section merely seeks to highlight its major milestones and turning points, from the origins of the telephone, to the development of its networks, to arrive at the revolution of mobile technologies and the Internet. It should be noted that, although a broad definition

of telecommunications (etymologically "communication from afar") would comprehend items such as radio and television – a kind of broadcast communication –, these have grown to be considered a separated industry, i.e. Media and Entertainment. On this regard, in fact, the distinction used by AGCOM in its official industry reports is followed.

This brief excursus is hereby presented from the technological perspective, i.e. the main breakthroughs and inventions, and subsequently from an economic perspective, which attempts to reconstruct the market structure of the sector and its changes over the years, while exploring the important role played by regulation and legislation.

1.1.1 Technological development: from fixed telephony to the explosion of the Internet and mobile technologies

A revolutionary means of communication at the time, the telephone invented by Antonio Meucci and patented by Alexander Graham Bell in 1876 has represented the core of the telecommunication industry for the whole twentieth century and still amounts for a significant share of it today. First commercialized in Italy in 1881, the telephone service encountered an unexpected demand as the government licensed it to private local concessionaries throughout the country (Balbi, 2011). The first long-distance connection between Milan and Monza, realized in 1904, opened up the new market for long-distance calls, creating a distinction between the two segments that will survive for decades, at least in terms of pricing. Still, both services relied on manual commutation until 1913, when the first automatic telephone exchange was built in Rome.

However, a substantial push to the development of the telephone network only arrived with a reform of the whole system in 1925, which instituted a state-owned company (ASST) responsible for long-distance and international connections, and licensed the local service to five private concessionaries which split the national territory into five corresponding regions of competence (STIPEL, TELVE, TIMO, TETI and SET). Since then, the 1950s and 1960s, with the economic boom, marked an intense growth of both the network itself, through major investments in infrastructure, and in the number of users, also thanks to new technologies such as copper coaxial cables, electronic telephone exchanges, the multiplexing technique, radio links and satellites.

In 1964, the five concessionaries were merged and incorporated into the electricity group SIP (until then Società Idroelettrica Piemontese), which changed its name into SIP - Società

Italiana per l'Esercizio Telefonico. The company, sole authorized telephone operator, was under the control of IRI (Istituto per la Ricostruzione Industriale), the public body responsible for industrial policy, thus making Italian telecommunications state-owned for the three following decades. This allowed for ever larger investments in the making and deployment of new technologies, especially since the creation of the R&D subsidiary of the group, CSELT. Among the most notable examples in the work of CSELT, the fiber optic was experimented in its labs in the early 1970s and the first cable in the world connecting two exchanges was laid down in Turin in 1977. The new technology did not suffer electromagnetic interferences, atmospheric electrical discharge and attenuation of the signal with long distances, thus making it much more efficient and reliable than coaxial cables. Thus, a fiber optic network started to be created and the new material gradually replaced copper in the national backbone network. (TIM Group, 2018).

The Nineties marked a well-known acceleration in technological changes, especially for telecommunications. On the one hand, the launch of the World Wide Web in 1991 at Geneva's CERN, with the establishment of the standard protocols for the Internet (TCP/IP, http, html, etc.), was the first of a series of innovations (e.g. browsers) that would soon make the new "web" actually accessible to ordinary users and capable of exchanging all kinds of information and media through data packages on this "network of networks". Needless to dwell on the exponential growth of Internet-based technologies and applications, together with IT technology in general, it will suffice to point out that ever since the activation of the ISDN network (1991) and even more after the launch of the ATM broadband network (1996), the telecommunications market has mostly remained divided into voice and data services, with the data share continuously growing.

On the other hand, the development of mobile networks radically changed not only how calls were made but eventually – as we all know – how the Internet is accessed. The first digital technology was the GSM network (Global system for mobile communication), launched in 1992, which allowed for roaming in European states but could still only support voice transmission. Passing through the first SMSs, access to the Internet was finally guaranteed by GPRS and thereafter EDGE technologies, which, together with GSM, constitute the main 2G technologies, still in operation today. The third generation arrived in 2000 with UMTS and, later, HSPA networks, which kept on increasing transmission speeds up until 4G networks (LTE), that now reach up to 1 Gbit/s in bandwidth and have already been disrupted by the nascent fifth generation (5G).

At the same time, fixed technologies kept evolving and granted increasing values of bandwidth: xDSL copper technologies, developed in the 1990s, and particularly the now universally spread ADSL (launched in 2000); copper and fiber-optic combined and full-fiber technologies (FTTx, i.e. FTTN, FTTC, FTTB, FTTH, where the final letter indicates to what extent to network is made of fiber). The overall industry, then, turned out to be divided into two distinct markets, fixed and mobile, and still is today.

1.1.2 Market structure and the role of regulation: from natural monopoly to the liberalization process and current regulatory framework

As previously mentioned, the whole Italian telecommunication industry has been in the hands of the state-owned monopolist SIP for three decades, that is from its constitution in 1964 until the liberalization of the market in the mid-Nineties. The liberalization process started with the establishment of European directives on market liberalization in 1987 and the release of the Green Paper on the Development of the Common Market for Telecommunications Services (Cambini & Soroush, 2016). The reasoning for liberalization, i.e. removing entry barriers for newcomers in the industry, found its roots in the broader debate around deregulation, started in the 1980s in the USA, which rejected the traditional idea that telecommunications services were natural monopolies, idea based on the assertion that having more than one company in the market would mean multiplying the high fixed costs of investment to build the infrastructures.

Indeed, natural monopoly was traditionally believed to occur when a market, for structural reasons, presented large economies of scale over the whole range of demand, particularly because of high fixed costs and low or zero marginal costs (Mosca, 2008), as it is the case for telecommunication services. Additionally, natural monopolies generally occur when significant economies of scope are present as well, i.e. the monopolist gains considerable savings by offering distinct services that share some costs (e.g. the network infrastructure). This means that the overall cost is lower if the whole industry output is produced by a single firm rather than two or more, condition known as subadditivity of the cost function:

$$C(y) + C(y') \geq C(y + y')$$

with y and y' being the outputs hypothetically produced by two firms (Christodoulopoulos, 1995). Clearly, whether or not such a condition is met depends on the level of output. Indeed,

in a similar fashion, subadditivity of cost can be used to assess whether a market is a natural monopoly, duopoly or oligopoly with a certain number of firms.

Consequently, as a monopolist is by definition a price maker, the path undertaken in Italy to ensure consumer's protection and welfare was that of a public monopoly, with regulated prices, so that: long-distance calls prices subsidized local calls prices; business calls subsidized households' calls; access fees were kept low to satisfy an equity criterion (Colombino, 1998). Such a system was employed in most countries since the early days of telephony in order to increase network penetration, recognizing the influential role of telecommunications in a country's economy and politics (Encel, 1991).

The configuration of telecommunications as a natural monopoly was then questioned in most advanced economies, highlighting its inefficiency, as monopolists do not have incentive neither to minimize costs nor to constantly innovate, since they do not face competition. Furthermore, pressures arose in most countries from large multinational business users, which demanded lower prices for their long-distance and international calls, questioning the subsidizing system (Encel, 1991). At the same time, however, the public importance of telecommunications was recognized in the principle of universal access to be pursued by governments. In Europe, not less relevant was the goal of realizing an integrated market for the whole EU, to ensure interconnection of infrastructures but also to compete with US and Japanese giants (Bulfone, 2019). The result of this debate was the process of liberalization of the industry, as well as privatization in countries where public monopolies existed, together with the institution of independent National Regulatory Authorities (NRAs), AGCOM in Italy (1997).

In Italy the process started with the privatization of SIP and the creation of Telecom Italia in 1994, through the merger of the five operating companies in the industry, four licensed concessionaries (SIP, Italcable, Telespazio and Sirm) and one publicly administered firm (ASST). Shortly after its birth, Telecom Italia was listed on the stock exchange, becoming the first Italian public company. The privatization process was concluded in 1998, while the Treasury kept a 3.4% share and a "golden share", i.e. the government's possibility to intervene in the incumbent's management for matters of national security interest. In 1999 Olivetti succeeded in acquiring a majority stake in Telecom Italia, but ever since a variety of – mostly foreign – stakeholders have come and gone, until the present configuration with the French group Vivendi as majority stakeholder.

As for the regulatory framework, the AGCOM was established in 1997 as an industry-specific version of AGCM (Italian antitrust authority), with the goal of customer protection and to "ensure that the market is accessible to everyone and competition is not hindered" (Cambini & Soroush, 2016). The institution has power over a variety of matters, including: operators' tariffs; interconnections, to ensure that all carriers have fair access to the incumbent's infrastructure; the realization of a universal service; frequency allocations for mobile markets; service quality.

Particularly, a central issue was that of interconnection, i.e. ensuring all new operators could have access to the backbone network of the incumbent at a fair (regulated) price. This issue prompted a discussion around the most suited alternative to avoid market power distortions in the retail market. In fact, liberalizing the industry entailed considering how the separation between the network and retail markets should be carried out. The two alternatives were: structural separation and functional separation. In the first, the wholesale function, which manages and maintains the core of the network, i.e. the backbone, is assigned to a separate independent company (or more than one), which sells access to the companies in the retail market, a sort of distribution market.

In the latter, instead, the two functions continue to reside in the same company, i.e. the incumbent, but in entirely separate business units, with the obligation to allow access to the network at the wholesale level to all firms, incumbent included, on the same terms. In this case vertical integration in the incumbent, but also in other firms, allows to take advantage of economies of scope between the two markets (transport and distribution), leading to lower overall costs in the industry and thus greater efficiency. For this reason, functional separation was the strategy adopted in Italy by the AGCOM to stimulate competition without incurring in cost inefficiencies (Mancuso, 2012).

As a result of liberalization, several new operators started entering the fixed telephony market in the 1990s, and others the mobile market in the 2000s, with Telecom Italia still retaining most of the access network. Although the entry rate eventually declined and several companies merged to cope with the high fixed costs and investments, overall the industry has moved towards a more competitive structure (Cambini & Soroush, 2016). Indeed, the share of Telecom Italia both in the transport and in the access market is constantly decreasing (AGCOM, 2019).

1.2 Structural features of the ICT industry

Regardless of the fact that policymakers eventually abandoned the idea of telecommunications as a natural monopoly, whether or not the industry actually presents subadditivity of costs at specific levels of output still remains a matter of discussion. An empirical study by Mancuso (2012), analyzing the cost structure of Telecom Italia for the period 1964-2000, concluded that the condition of subadditivity of cost was met, thus supporting a monopolistic structure. However, if this is true for telephone networks, it may not be so for the wide array of services that telecom operators offer today, since technological development made room for a variety of products and services and a myriad of providers and suppliers. As a simple example, it is much more feasible for smaller companies to enter the market now that the backbone infrastructure is already in place and only a "last mile" connection needs to be built. Furthermore, as the volume of usage continues to increase, networks expand and become harder to manage by a single company (organizational diseconomies), the subadditivity condition detected by Mancuso (2012) may simply not hold anymore.

Still, as natural or unnatural as it may be, the fact remains that the sector today is evidently configured as an oligopoly rather than a perfectly competitive market. Such a claim is supported by the evaluation of market concentration, for which the Herfindahl-Hirschman Index (HHI) was used. In particular, it was chosen over the CR_4 Index, the other most used concentration index, because it provides a more complete understanding of the observed market, as it is sensitive not only to the sum of top players' market shares, but also to the individual size of each market share (Naldi & Flamini, 2014).

In fact, the CR_4 index is simply the sum of the market shares of the four largest players in the market, whereas the HHI is the sum of the squares of all market shares. In a market with *n* companies, with the market share of the *i-th* company being s_i, the HHI[2] is calculated as:

$$HHI = \sum_{i=1}^{n} s_i^2$$

[2] If the market shares are expressed as fractions, i.e. $0 < s_i \leq 1 \quad \forall i$, then $0 < HHI \leq 1$. Instead, if they are expressed as percentages, i.e. $0 < s_i \leq 100$, then $0 < HHI \leq 10000$. The two extremes of the scale are 1 (or 10000) in case of monopoly, and $\frac{1}{n}$ in case of perfect competition with all n firms having an identical market share of $s_i = \frac{1}{n}$.

In order to evaluate market concentration, the US Department of Justice and the Federal Trade Commission (2010) provide useful guidelines, reported in the following table:

HHI	***Competition level***
<1500	Unconcentrated markets
1500-2500	Moderately concentrated markets
>2500	Highly concentrated markets

The HHI was calculated for the last five years on the basis of data and information provided by the AGCOM's annual reports (2015-2019), for both fixed and mobile telecommunications. The results are reported in Figure 1.

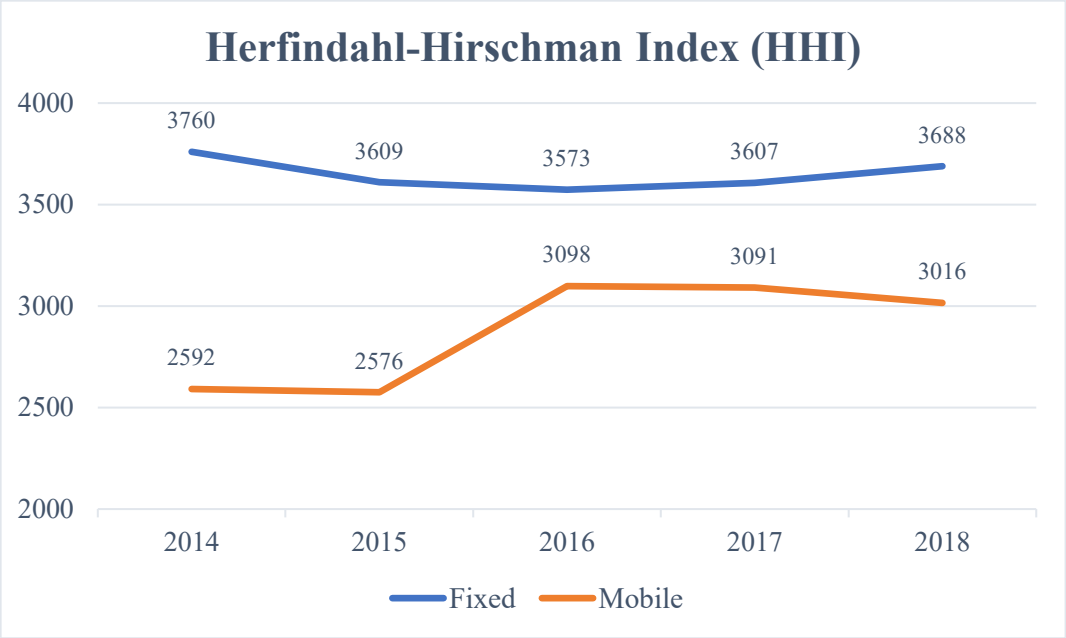

Figure 1: Herfindahl-Hirschman Index in 2014-2018[3]

The graph shows consistently high values of the index for the latest 5 years, although with a visible gap between the fixed and mobile markets. The difference is mainly due to the much lower share of the incumbent in the mobile market: around 35% in 2018, as opposed to almost 58% in the fixed market (AGCOM, 2019). Still, the industry as a whole is undoubtedly a highly concentrated one, configured as an oligopoly. In particular, the swift

[3] AGCOM data on market shares was used to compute the HHI. However, in the fixed market the last 7-8% was generically reported as "Others". To reduce the approximation of the index, this percentage was divided by 10, as if the market share were divided among 10 identical firms – a simplified but realistic measure, considering the effectively operating firms in each year. For the mobile market, instead, since the quotas in the MVNO market were reported, this operation was not necessary to reach a decent approximation.

increase in 2016 is explained by the merger between Wind and Tre, named WindTre since then, testifying the tendency of telecom carriers towards consolidation, through mergers, acquisitions and partnerships. Another example of such a behavior is the recent agreement between Tim and Vodafone to develop a shared 5G network infrastructure through the new company Inwit, controlled in equal measure by the two.

As it was mentioned, the reasons for concentration and consolidation in the telco industry can be found in some of its distinguishing features. First of all, the industry has long reached its maturity stage and thus saturation, which means competition is particularly fierce and based on market stealing rather than market growing. Secondly, the cost structure of telecom operators is characterized by high fixed costs - for the design, construction and maintenance of the network- as opposed to marginal costs close to 0 (the cost of having an extra subscriber in the network is virtually non-existent, except for the realization of ad-hoc connections).

Indeed, a crucial concept for the description of telecommunication industries is that of network externalities. Network externalities occur when the value of a good depends on the number of other people that use it. In other words, in a network industry, the utility of a consumer i depends both on the quantity consumed q and on the number N of agents in the market that consume the same good (direct externality):

$$U_i(q) = U_i(q, N)$$

This means that every additional user generates a positive externality for existing network users, as connection possibilities increase and the cost for *on net* communications decreases. Specifically to telecommunications, Metcalfe's law states that the aggregate value of a network is proportional to the square of the number of its users (n^2), as individual value is linearly proportional to network size. However, critics of Metcalfe's law observe that the overall value of the network does not increase indefinitely with the number of users, but instead the relationship between aggregate value and network size shows diminishing returns, as pioneer users get more value from each additional user than late adopters do (Swann, 2002).

This is even more evident in presence of congestion costs, which increase with network size and decrease individual utility (e.g. the network is slower or poorly functioning): this effect represents a negative network externality. Positive and negative network externalities combined mean that a network needs to reach a critical mass to survive (Rohlfs, 1974), but

at the same time over a certain threshold any additional user will only decrease utility for all users.

Another structural feature of telecommunications markets, which is easily understood, is the concept of path dependence in technological evolution. A process or strategic choice is path dependent when its outcome depends to a certain extent on the historical process behind it. This means each choice is dictated in some measure by previous choices, because at any given time the firm has a set of strategic assets that depend on its previous long-term investments. In telecommunications, investments are not only long-term but also nearly irreversible. Furthermore, the ICT industry in general is characterized by the emergence of both de facto and institutionalized standards and lock-ins. This means that any innovation needs to build on existing standards to succeed, or rather has a significant advantage by exploiting an existing infrastructure. An illustrative example of lock-in in the industry is the time needed to adopt the new IPv6 protocol, which solved the problem of limited address space in its IPv4 predecessor: IPv6 reached critical mass only in 2017, even though it was invented in the mid-1990s (Heinrich, 2014) (Pickard, et al., 2018).

Despite all the efforts in ensuring fair competition and prevent abuse of market power, path dependence - and resistance to change in general - still represents at the same time a kind of first-mover advantage and a disadvantage in innovating for incumbents like Telecom Italia. In fact, on the one hand, the long-lived carrier can enjoy economies of scale and scope for its already-existing extensive network and learning economies for all the maintenance, management and business-related activities. On the other hand, it can prevalently engage in incremental improvements of the infrastructure and not, for instance, build an entirely new and state-of-the-art network like the new wholesale operator Open Fiber. Still, possibly the greatest drawback is in organizational and managerial culture, since within such a large firm with such a long history, old ways are generally harder to abandon with respect to newly born companies.

All these complex dynamics are tightly interrelated and typical of telecommunications networks (for both telephone and Internet markets), explaining their oligopolistic nature, but as the industry grows in volume, complexity, number of services and complementarity with the IT market, fragmentation, disaggregation of the value chain and competition increase.

1.3 Current scenario and market trends

As a consequence of the activity of the AGCOM on the one hand and of technological development on the other hand, the telecommunication industry is seeing trends of increased competition and commoditization of its core products and services. Therefore, carriers' choice of expanding their offering towards a variety of different products and services beyond the core phone and data connectivity seems natural and almost obvious. But this diversification path undertaken by almost every telecommunication operator is to be framed within a broader phenomenon of convergence between the telecom and the IT industry. These themes, which characterize the present industry scenario, are individually discussed in the following paragraphs.

1.3.1 Competition

As previously mentioned, ever since the liberalization of the market, telecommunications have moved towards a more competitive structure both in the fixed and in the mobile market. In fact, both mobile and fixed operators can buy access to the transport network or rent the incumbent's infrastructure at the wholesale level. Indeed, the first major division line to be drawn to understand the structure of the industry is that between intermediate and retail services, where the first comprises Telecom Italia's offering for unbundled access services and wholesale rental, both for copper and fiber networks, whereas the latter is the whole range of services offered directly to households and business users.

However, in 2015 the creation of the wholesale-only operator Open Fiber completely disrupted competition even in the intermediate services market. In fact, since then, Open Fiber has completed a whole new national backbone optical network, called Zion, and is currently realizing a 6-year plan for a nation-wide ultrabroadband network (100 Mbps and more) that will comprehend 270 Italian cities and 9.5 million residential units. The wholesaler, with equally shared ownership of Enel and CDP (the Italian Deposits and Loans Fund), is realizing its infrastructure relying on both private investments, to cover profitable areas, and public funding, targeted at "white areas" or "market failure areas", i.e. those areas whose wiring is not economically convenient for operators because of low-density housing and geomorphological reasons.

Open Fiber, in fact, won all the tenders issued by the governmental body Infratel for the realization of ultrabroadband connections in the white areas, by proposing a ca. 80% FTTH

and 20% FWA (Fixed Wireless Access) coverage. Overall, Open Fiber's entrance in the wholesale business poses a significant threat for the incumbent in this tightly regulated market, in which revenues are tendentially decreasing due to the price reduction imposed by the Authority (Figure 2).

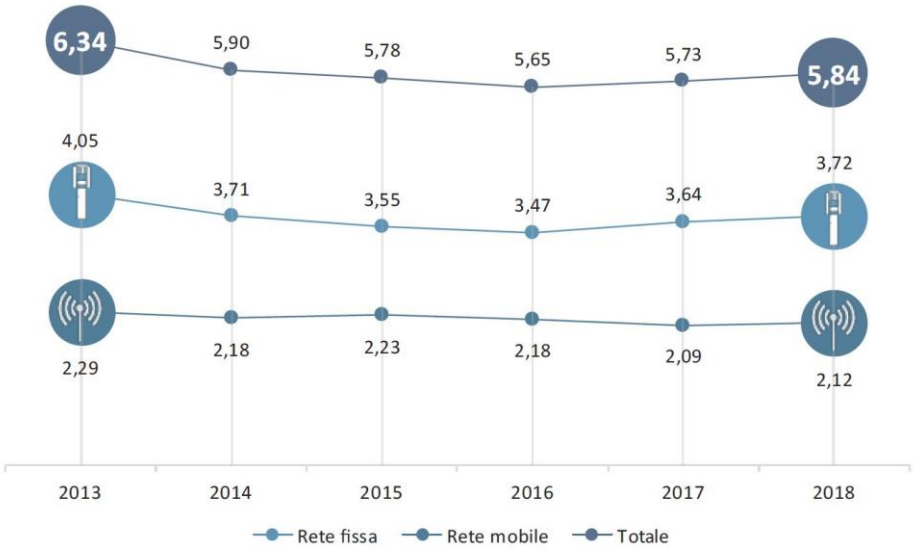

Figure 2: Revenues in Intermediate Services (source: AGCOM, 2019)

In the retail market, the dynamics of competition have been especially turbulent in the mobile market in the latest years. First, the merger between Wind and H3G (commercially known as Tre) in 2016 marked a significant increase in concentration, as the share of the first three operators leaped from 78.6% to 85.4% in just a year (AGCOM, 2017). The two players, now WindTre, reached a joint market share of 21.6% and retained an almost-20% up until 2018, remaining close to Vodafone with regards to overall revenues.

This increase in concentration was approved by the Authority because of the perspective entrance of the new Mobile Network Operator (MNO) Iliad, which launched its commercial offers and became fully operative in 2018. The impact of Iliad's entrance was significant in increasing competitive pressure in the mobile market: as a low-cost operator it dragged down Average Revenue Per Unit (ARPU), resulting in a decrease in the Average Revenue per SIM and per user, respectively of 4.5% and 6.4% (AGCOM, 2019). The effects of such intensified competitive pressure are particularly visible in the revenues coming from data services, which suffered a sharp drop (-7.8%) in overall terms. Furthermore, Iliad's low-priced offering forced market leaders TIM and Vodafone to launch their own low-cost brands, Kena Mobile and ho. mobile to tackle the low-end of consumer demand and directly compete with

Iliad. Indeed, the operator that seems to have suffered the most from its entrance is WindTre, with a 2% decrease in its market share (Figure 3).

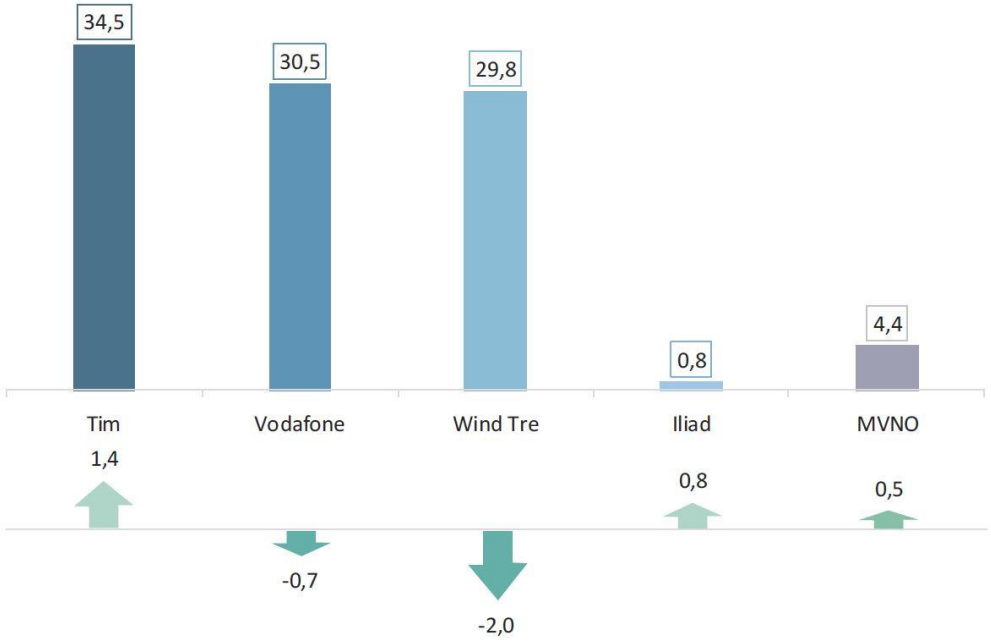

Figure 3: Market shares in the mobile market (source: AGCOM, 2019)

The graph clearly shows the configuration of the market as a tight oligopoly, with the three players having comparable market shares. However, as 2018 was merely the first year of Iliad's activity in Italy, the further effects of its entrance are yet to be seen. Instead, the expansion of MVNOs (Mobile Virtual Network Operators), i.e. those operators that rely on MNOs' infrastructure to offer their services, still appears limited in size, with a market share of around 4% throughout the latest 5 years, although increasing in 2018.

A useful measure of overall competitiveness in the mobile market is represented by the mobility index, relative to the total number of acquired and discontinued lines through the service of mobile number portability, over the total customer base. The mobility index increased from 35.9% to 40.8%, together with the annual number of portability operations displayed in Figure 4. This index reveals the ease with which users can switch between operators, as well as the increased frequency with which they do so, confirming the strong competition between market players.

Figure 4: Number of annual portability operations and cumulative total (source: AGCOM, 2019)

Increased competition was also a dominant trait of the fixed market in 2018. Even though the incumbent still retains an unreachable 57.7% share of revenues (Figure 5), with an uncontested primacy in both the residential and business segments, in terms of access lines TIM has seen a 12pp decrease in the period 2013-2018, to the advantage of Vodafone (+4.6pp), Fastweb (+3.6pp) and minor operators (+4.4pp), leaving WindTre essentially stable (-0.2) (AGCOM, 2019). It should be noted, moreover, that TIM's supremacy is less pronounced in the broadband services segment, where it holds a 38% share (increased of 1.6pp year-on-year) and its closes competitor, Fastweb, has a 26.2% share (decreased of 2.2pp).

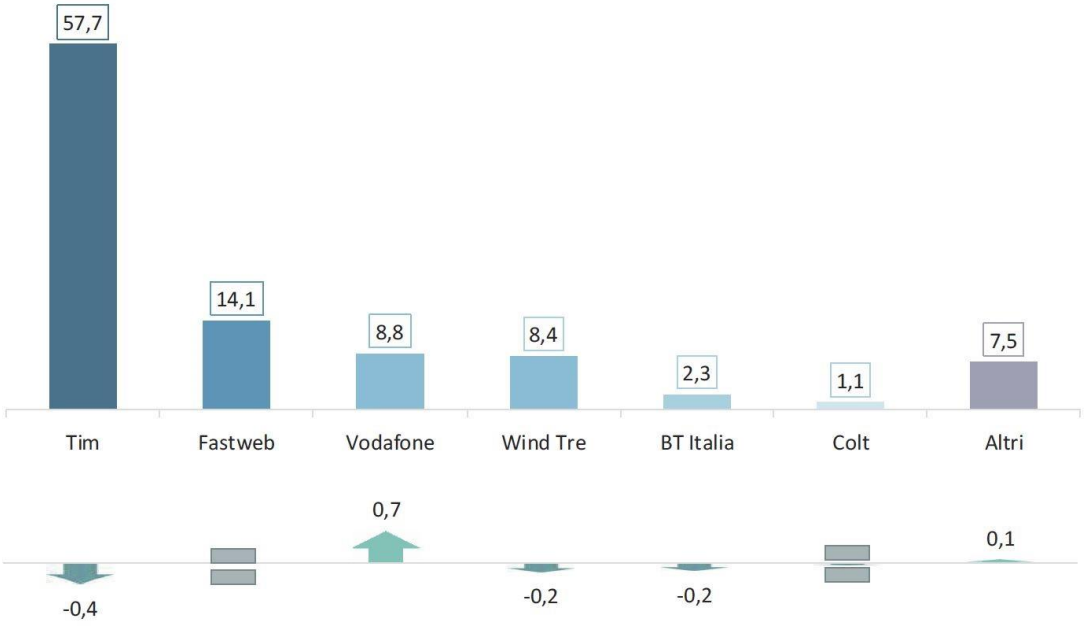

Figure 5: Market shares in the fixed market (source: AGCOM, 2019)

Finally, an interesting dynamic of the fixed market is represented by the FWA (Fixed Wireless Access) segment, i.e. a wireless broadband connection that uses a mix of fiber and radio technologies, particularly useful for hardly reachable sites. The segment has been growing steadily in the last five years, with a rate of 30% in 2017 and 16.5% in 2018, reaching a business volume of €265 million. Though still a marginal phenomenon in the market - roughly 2% of revenues – FWA operators are conquering neglected market niches and are yet another evidence of the dynamism and complexity of the telecommunications industry.

1.3.2 Commoditization

A distinctly recognizable trend in the telecommunications industry is the commoditization of its core products and services, i.e. telephone and Internet connectivity services. The term "commoditization" describes a phenomenon that strips goods within a certain category of their distinguishable and unique features, making them easier to compare for consumers and harder to differentiate for firms. In other words, it is the process through which products and services of a certain kind become commodities, i.e. goods for which competition is solely based on price. As a consequence, operators' profits inevitably squeeze as prices approach costs and long-term high-margin growth perspectives become scarce.

In the last decade or so, this process was particularly evident in the mobile communications market, where the smartphone revolution dominated by tech giants Apple and Google, with their respective ecosystems of OS and relative apps, essentially commoditized voice and data plans offered by carriers. In fact, the vast range of value-added services they offered in bundled or add-on offerings were for the large part swept away by the universe of better-functioning apps that both iOS' App Store and Android's Google Play Store could offer. Arguably, "the smartphone revolution was, in essence, a takeover of the mobile communications industry by the [US] computer industry" (Kushida, 2015).

What happened over the course of the last decade is that, as smartphones widely spread throughout developed and developing countries – and rapidly became commodities themselves–, the demand for (especially mobile) data services kept increasing dramatically, causing equipment vendors to continuously devote their R&D efforts in increasing network capacity. However, carriers were only marginally able to capture higher profits due to increased demand, as the general trend of stagnating or even declining ARPU demonstrates (Glimstedt, 2017).

In the Italian market, the commoditization trend as hereby defined, can be shown by two simultaneous trends: increase in the consumption of data traffic and falling revenues. The first is visible both in the fixed and in the mobile market and is largely driven by the increased fruition of data-intensive content online (particularly social networks and video streaming) and enabled by the nation-wide diffusion of broadband connectivity (e.g. ca 85% of all fixed access lines in 2018 were broadband lines). Indeed, Figure 6 shows, with 2013 as 100-base, the dramatic increment of data traffic in fixed connectivity.

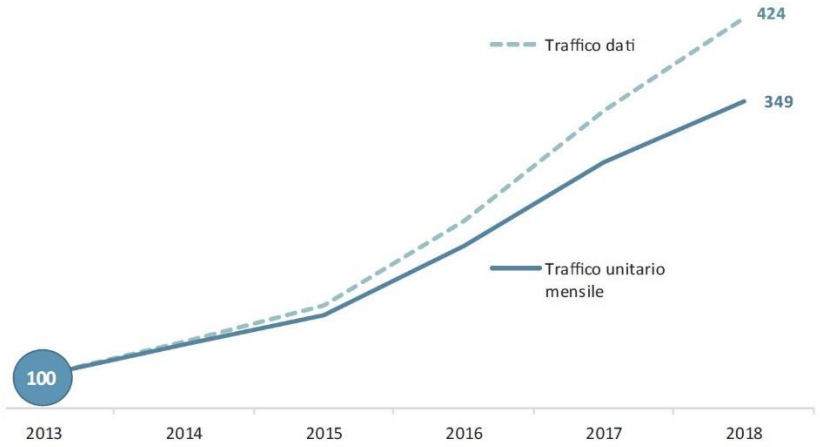

Figure 6: Data traffic and unit monthly data traffic from fixed connectivity (source: AGCOM, 2019)

The mentioned trend is possibly even more striking in the mobile market, where the rise of data traffic runs at a 50% annual rate and reached 1700 Petabytes in 2018 (AGCOM, 2019). Furthermore, the average monthly data consumption amounted to 4.27 Gigabytes/month, with 56% increase year-on-year and a 396% increase over the 2013-2018 period (Figure 7).

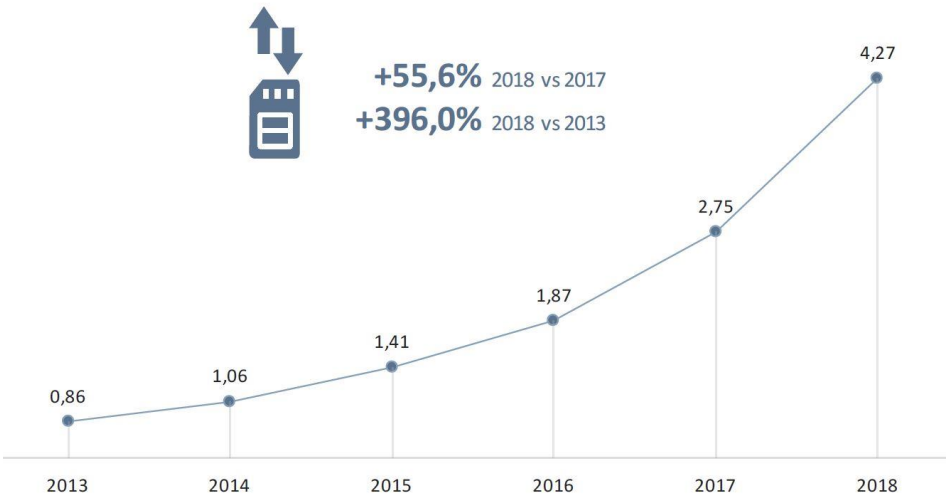

Figure 7: Average monthly data traffic of data SIMs (Gigabytes/month)

As for revenues, at the industry level 2018 saw, for the first time, a suspension in the growth trend of revenues from data services. In fact, after a continuous increase that surpassed the declining voice services in 2016, data services have yielded €11.82 billion in 2018, slightly less than previous year's €11.95 billion (Figure 8).

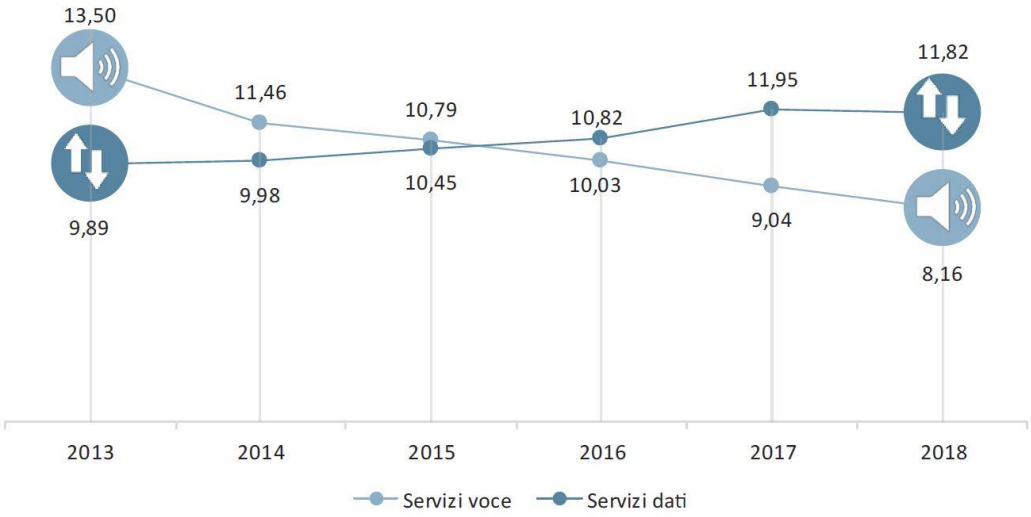

Figure 8: Revenues from voice and data services (billion €) (source: AGCOM, 2019)

If the trend is yet hardly noticeable in the fixed market, where revenues from data services are still growing (+5.3%) as an effect of the increased number of broadband subscriptions, it is undeniable in the mobile market, where the bending of revenues (-7.8%) from data services was aggravated by the heightened competitive pressure after the entrance of Iliad. Examining unit revenues further confirms the reported trend: ARPU per SIM and per user respectively declined of 4.5% and 6.4%; unit revenues of voice services (€cent/minute) decreased of 12.1% and those of data services dramatically dropped from 3.17€/Gb to 1.87€/Gb (-41%) (AGCOM, 2019).

At the aggregate industry level, the interrelated effects of increased competition, regulation and commoditization are visible in the decline of retail prices (Figure 9) and the overall stagnation of industry revenues, which have remained close to €32 billion in the last 5 years, with small increases or decreases. In particular, last year marked a 2% contraction, as an average of the 1.2% increase in fixed telecommunications and the 5.3% decrease in the mobile market, largely due to the described phenomena.

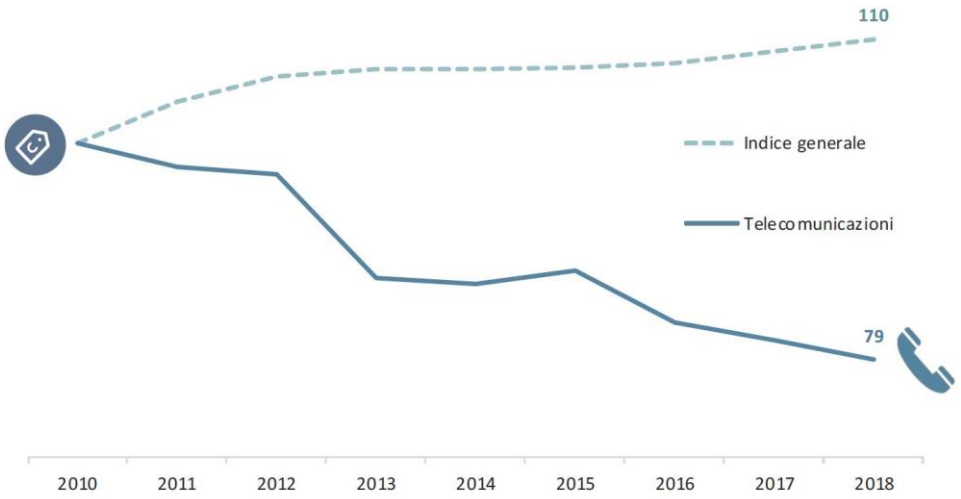

Figure 9: Prices trend (general index vs telecommunications) with 2010=100 (source: AGCOM, 2019)

1.3.3 Diversification and ICT convergence

Undoubtedly, telecom operators today offer an enormous variety of products and services, for both residential and business users, that was not nearly conceivable two or three decades ago. On the one hand, new technologies have allowed carriers to offer different kinds of services within the boundaries of telecommunications, to best suit specific customer needs, e.g. FWA services, MPLS networks, VPNs[4] and dedicated APNs just to name a few; on the other hand operators have long started to provide more than mere connectivity, ranging from all kinds of related devices (e.g. smartphones, tablets, PCs, smart TVs, routers, Private Branch Exchanges and so on) to integrated communication platforms and services (e.g. Unified Communication and Collaboration, videoconference tools), to an assortment of IT services, media and entertainment content and even payment systems. The reasons behind this explosion are to be found not merely in the technological development that made such complexity possible, but in a distinct diversification strategy adopted by most carriers. This, in turn, was enabled by a process of convergence of telecommunications with the IT and media industries, and arguably motivated precisely by the commoditization process previously discussed.

The convergence of ICT industries is a phenomenon observed and commented since the end of the 1990s (Messerschmitt, 1996). The term refers to the coming together and integration of the previously independent computing, telecommunications and media industries. First of all, this was visible from a technological perspective in the development of the devices, with

[4] VPN: Virtual Private Network

the smartphone being the most notable example of a unique instrument providing a number of services that were previously delivered by all sorts of different tools (cameras, MP3 players, radios, satellite navigators, etc.). Another more recent example is the Software Defined Networking (SDN), melting together networking equipment, cloud computing and network operation to realize better-performing and easier-to-monitor networks.

ICT convergence implied, on the one hand, that intensified collaboration was needed between firms belonging to different compartments of the ICT industry, i.e. hardware manufacturers, software houses, Internet Service providers (ISP) and consulting firms, in order to merge competences to realize products and services based on different technologies. On the other hand, it allowed for cross-sector diversification, insomuch as firms operating in one sector started to expand into closely related ones to the point that boundaries between these sectors have become increasingly blurred and lost their meaning. This has left telecom players in the continuous search for value-added services (VAS) to provide as integration or bundles with their core offers. In fact, in the context of telecommunications, VAS refers to all services that are considered non-core, i.e. besides voice and data, and nowadays include all sorts of applications, from online storage to music and video subscriptions and communication platforms. The reasoning behind this strategic move evidently lie in economic considerations, as they allow carriers to capture higher margins and a greater share of value.

In particular, Wulf & Zarnekow (2011) analyzed the intensity of cross-sector competition of Telecom firms in the other compartments of the ICT industry, i.e. Media, Software and Internet applications, Hardware equipment. The study identified strong structural linkages between firms operating in these markets, because they tend to diversify within the boundaries of the ICT industry and "diversification activities outside the ICT sectors are pursued to a much lesser extent", confirming the hypothesis of ICT convergence. Furthermore, the analysis found the strongest diversification activities of telecom operators in the Media industry, because of the economies of scope granted by shared marketing resources, and in Software and Internet applications, because telecommunication applications themselves are increasingly based on software and programmable networking hardware. This intense diversification activity, with possibly the only exception of Media companies, seems to be almost one-sided: firms in other sectors hardly every diversify in the telecom business, as the costs clearly outweigh the benefits (Figure 10).

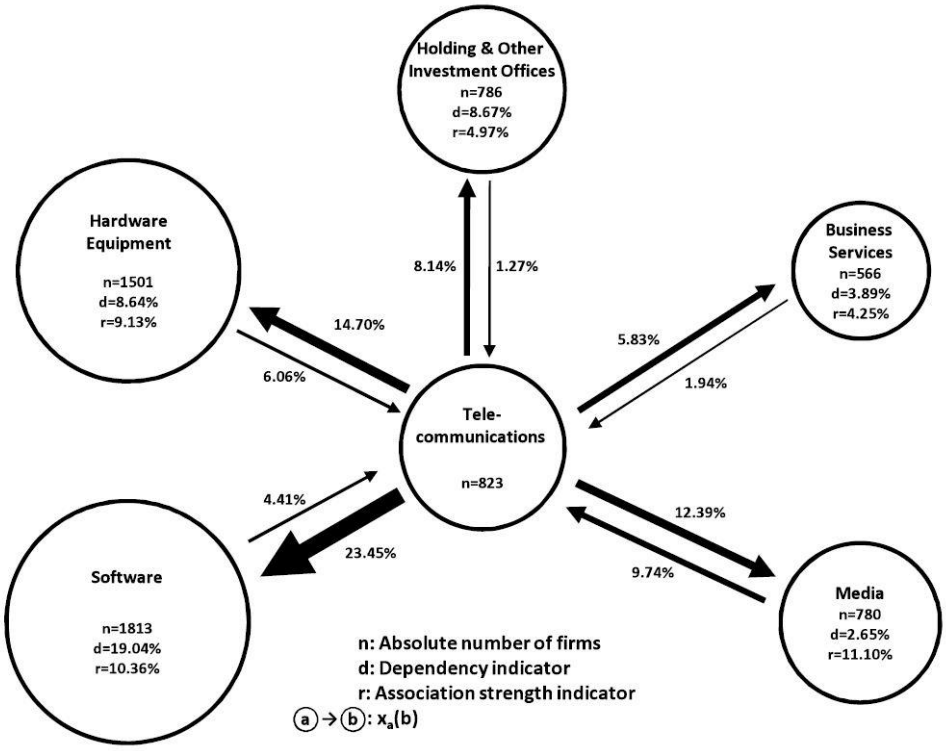

Figure 10: Directional diversification relationships between the TLC and other related sectors (source: Wulf and Zarnekow, 2011)

However, in these new markets telecom operators face threatening competition from the so-called Over-The-Top (OTT) players, such as tech giants Google, Microsoft, Amazon, Facebook, Netflix and Spotify – called OTT because they provide their services over the network, bypassing the distribution traditionally prerogative of telco carriers or TV providers. The question left to address, then, is how telecommunication firms are positioning themselves in the transformed competitive scenario and what manoeuvre space they will actually have in the ICT arena in the development of new convergent technologies and services, ever more complex and ever more personalized.

Chapter 2: TIM and the diversification strategy

Along with the telecommunications industry, the incumbent Telecom Italia – TIM since 2016 – has undergone over two decades of turbulent transformation in its business, activities, structure and competitive positioning, transitioning from monopolist to dominant player in a liberalized competitive market. Its continuous renovation has been dictated on the one hand by conscious strategic choices and on the other by all sorts of exogenous variables addressed in the previous chapter – competition, ICT convergence, technological evolutions and disruptions, commoditization of voice and data services.

In the Italian competitive scenario, TIM's position and role appears to be particularly interesting to analyze, because of its history and legacy, its size and macro-economic relevance in an industry that is pivotal not only for the country's technological advance and economic development, but also, consequently, for its prospects in the international geopolitical environment, such as the leadership for the fifth generation of mobile technologies (5G). As a matter of fact, TIM's social role as detainer of major infrastructures, responsible for delivering universal service and bridging the digital divide, is not to be overlooked.

With a 50% share of accesses, 58% market share in the fixed and 35% in the mobile sectors, TIM is at the forefront of Italy's digital transformation, enabling the transition for everyday users but also, and especially, for the fabric of businesses that strive to make the digital society possible through innovations like the Internet of Things, Industry 4.0, Artificial Intelligence, Cloud Computing and so on. This position as technological enabler is notably crucial for SMEs, around 92% of all Italian firms (Il Sole 24 Ore, 2019a), of which a strong majority relies on the incumbent for the provision of telecommunication services, i.e. the 63% in 2017 (AGCOM, 2017).

With regards to innovation, its potential is somewhat double-edged: on the one hand, being a well-established company, TIM can exploit its core markets as a "cash cow" to fund investment in R&D, as well as its dominant position to build robust networks of partnerships, suppliers and clients; on the other hand the gigantic and bureaucratic organizational structure of a large firm, the unsteady managerial and financial situation and the need to retain and maintain the core businesses may render it less agile or daring in undertaking bold innovation paths.

Therefore, TIM's logic and reasoning behind the diversification strategy is not only valuable to examine in itself, but also for the impact it has on wider national and international dynamics. This chapter, then, abandons the holistic market perspective and, after a company overview, addresses the concept of business diversification as studied in the literature, to ultimately understand how and why TIM is adopting this strategy, especially in the Cloud Computing market – discussed in Chapter 4 – as a reaction to exogenous trends and as a long-term strategic plan.

2.1 TIM: an overview

2.1.1 Group structure

TIM Group represents the largest ICT group in Italy with 47.665 employees (57.316 worldwide), 31.6 million mobile customers and 17.6 million fixed retail and wholesale accesses. The Group, unified under the umbrella brand TIM in 2016, comprises a core domestic business unit, the international wholesaler Sparkle and the Brazil Business Unit. The domestic BU comprises the units relative to the Consumer, Business and Wholesale markets, as well as a few subsidiaries operating in specific segments, among which:

- Olivetti spa, 100% controlled by the Group, operating in the market for IT products and services and specifically the innovative technologies of IoT, M2M and Big Data;
- INWIT spa, controlled to 60%, responsible for the mobile radio transmission infrastructure, both for TIM and for other operators;
- Telsy Elettronica Comunicazioni spa, the cybersecurity expert of the group;
- Noverca srl, which manages the new low-cost brand Kena Mobile;
- Telecom Italia Trust Technologies, which offers digital services like PEC (Posta Elettronica Certificata – Certified Electronic Mail), Digital Identity, Digital Certificate, Digital Sign and document dematerialization;
- TI San Marino, TN Fiber, Persidera and Flash Fiber operating in the wholesale sector.

In the international sphere, TIM's presence is in the hands of the Telecom Italia Sparkle group, which develops, maintains and sells fiber optic networks to wholesale customers in the European, Mediterranean and South American areas, and of TIM Brazil – officially TIM Participações S.A. –, which is controlled by the Group to roughly 67% and has a strong

presence as mobile and fixed operator in the Brazilian market, with 55 million customers and a 24% market share in the mobile market.

2.1.2 Reference markets

In the domestic market, the parent company Telecom Italia spa is active in three major segments, i.e. Consumer, Business and Wholesale. To consumers, the service portfolio extends beyond home and mobile connectivity into entertainment content, with the streaming platforms TIM Music, TIM Vision and TIM Games, payment systems with the prepaid card TIM Pay, and IoT with the platform IoTIM and its related devices. TIM Business, instead, deals with modular and customizable solutions for two distinct segments, private companies and public administrations, each in their different declinations of size and scope. The solutions offered include convergent fixed and mobile plans, VoIP communications, IT applications (such as data storage, security and video-surveillance), available on the platform TIM Digital Store, and a Cloud Computing platform, for the development or migration of enterprise applications in a cloud environment. Beyond off-the-shelf packages, complex ICT solutions, especially for the most innovative applications, are provided with a varying degree of personalization, to the point that new services are designed and experimented with the largest clients in tailored projects.

Finally, the Wholesale BU, functionally separated in the organizational structure as discussed in Chapter 1, allows Other Licensed Operators (OLOs) to utilize TIM's infrastructures, ranging from broadband and ultrabroadband networks (Ethernet or ATM), to radio and satellite technologies, from fiber optic connections to the traditional telephone network (RTG or PSTN). As illustrated in the previous chapter, the wholesale offer is tightly regulated by the Authority and forbids any kind of preferential treatment, collaboration or communication between this BU and the rest of the Group.

2.1.3 Competitive position in Italy

As mentioned in Chapter 1, TIM's dominant position has been challenged by its competitors in both the wholesale and retail markets. Overall, the infrastructuring processes undertaken by other operators resulted in an increase in their investments in fixed assets of over 50% in 2018, while TIM has reduced them of 20% (AGCOM, 2019). Particularly, Open Fiber's consolidation as wholesale operator is certainly a threat in a market where the room for manoeuvre is limited by regulation. Indeed, competition from Open Fiber urged TIM to

accelerate its plans for the full realization of its ultrabroadband network, and to devise a proposal to participate in the tendering process of "White Areas", which was eventually lost.

Even in the retail market, the expansion of competitors' access networks threatens the incumbent's position as it can less and less rely on its vast infrastructure as a unique strategic asset to compete. Still, TIM is still by far the first provider in the fixed market, both for the residential (58.3%) and business segments (57.2%), with Wind Tre, Vodafone and Fastweb as closest competitors in the first and Fastweb in the latter (Figure 11).

Figure 11: Market shares in the Residential and Business fixed market segments (source: AGCOM, 2019)

In the mobile consumer segment, although not yet significantly visible, the increase in competitive pressure due to Iliad's entrance has put a strain on all operators. However, TIM was more resilient than its competitors, managing to actually increase its market share (+1%), while Wind Tre – the segment leader – and Vodafone both lost ground, respectively of -1.1% and -1.5% (Figure 12). Furthermore, TIM strengthens its leadership in the (much smaller) business segment, where Wind Tre suffers a significant decrease. Still, the positive results in terms of market shares do not mean that financial performance is unaffected by the new competitive scenario, as discussed in the next paragraph.

Figure 12: Market shares in the Residential and Business mobile market segments (source: AGCOM, 2019)

2.1.4 Ownership and financial position

Telecom Italia spa is a publicly traded corporation, listed on the Milan Stock Exchange since 1997. It has also been listed on the New York Stock Exchange until July 2019, when it deregistered as a consequence of its cost saving and simplification policies. As of June 30th 2019, its shareholder base mainly consists of retail investors (480,000), though in terms of ownership the largest cut belongs to institutional investors (commercial banks, mutual funds, hedge funds, etc.), mostly foreign (43.77%) and in small part Italian (1.91%), while other individual investors amount for the 9.86%. Still, the majority shareholder is by far the French media group Vivendi (23.68%), followed by CDP – Cassa Depositi e Prestiti, the Italian Deposits and Loans Fund – with its 9.89%, and the hedge fund Elliot Management Corporation, headed by the US entrepreneur Paul Elliot Singer (the remaining 1.08% are treasury shares).

The described ownership structure was recently theatre of a series of internal battles between Elliot and Vivendi for the governance of the Group and the designation of TIM's top management, resulting in frequent changes not only in the Board of Directors but even of the CEO. In this scenario, the CDP, as state-controlled investor, acted as mediator and guarantor of national interests, especially as it regained a position of second shareholder in 2019, wishing to realize a country-wide fiber optic fixed infrastructure (La Repubblica, 2019). So far, these tensions arguably hindered the Group's capacity to formulate and enact long-term strategic plans, along with instability in the financial outlook.

As a matter of fact, the financial situation of the Group has been marked by high levels of debt exposure at least for the last two decades, thus forcing all administrations to worry about deleveraging. Lastly, the current leadership headed by CEO Luigi Gubitosi, with his "TIMe to deliver and delever" 2019-2021 plan, is on track to reduce the Group's leverage through cost savings, divestitures (such as the ongoing sale of Persidera), and cash generation in general. In fact, in the first two quarters of 2019 it has obtained a €539 million decrease in its net financial debt, amounting to €24.7 billion in June 2019 (TIM Group, 2019b).

For what concerns financial performance, Fiscal Year 2018 has seen substantially stable revenues and EBITDA, as a result of opposing trends in the different market segments. First of all, Iliad's entrance reduced mobile consumer revenues but was successfully counteracted by the ARPU growth due to price increases seeking a premium positioning of the mobile brand; indeed, TIM was best performer in reacting to the new entrant and MVNO threat, with a 3.1% decrease in mobile service revenues (TIM Group, 2019a).

Price increases have also aided the performance of the retail fixed compartment, with a growing ARPU (+8.7% YoY), and, along with a strong customer migration to fiber subscriptions, have offset the negative impact of the aggressive pricing strategies adopted by competitors and of the 28-days billing roll-back (AGCOM's rejection of the 28-days billing schemes and obligation to return to monthly billing). Furthermore, strong positive contribution to revenues were: the share of ICT in the business segment, growing 15% YoY, and particularly of Cloud services to the Public Administration; the 1.7% growth YoY of wholesale revenues in Q4, despite the 3.2% drag from regulated prices; the strong results of TIM Brazil, i.e. +4.7% service revenues (TIM Group, 2019a).

Hence, total service revenues amounted to €17,623 million, with an almost flat variation of 0.4%, whereas EBITDA suffers a -3.4% decrease, highly impacted by non-linear items such as the 5G frequencies auction held in 2018. In fact, the EBITDA margin was 42.4% excluding non-recurring expenses, -1.6pp YoY. Overall, 2018 was recognized to be a challenging year for the reported issues of leverage, competition and regulation, to which the Group responded with mixed results, although showing more resilience than competitors (TIM Group, 2019a).

As for the latest domestic results, the first half of 2019 saw continued positive trends in the fixed-line segment (increased ARPU, growing broadband and ultrabroadband customers), more favorable regulated wholesale prices and growing business ICT revenues. In the mobile

segment, the ARPU interrupted its downward trend, while Mobile Number Portability declined (after Iliad's disruption) and churn rate fell by 1.7pp YoY. Domestic Wholesale and TIM Brazil still drive revenue growth, although a revision of Sparkle's international strategy to avoid low-margin contracts and bad debts caused a €96 million decrease in revenues, not entirely upset by other positive contributions. Indeed, the overall effect is a substantially stable situation in the effort to contain costs and deleverage: -3.9% in revenues YoY and -2.6% YoY in the EBITDA, though with an EBITDA margin of 42.2%, +0.6pp YoY (TIM Group, 2019b).

2.2 Diversification

The concept of diversification has been widely researched and debated by the literature, from a variety of fields and points of view, starting from Strategic Management (SM) and afterwards ranging from marketing to industrial organization economics. Research interests on the topic have tackled not only the conceptualization and definition of diversification, but also its different facets and typologies, its directions, the motivations behind it and ways to attain it, as well as qualitative and quantitative estimates of its impact on corporate performance (Ramanujam & Varadarajan, 1989).

A broad but comprehensive definition is provided by Ramanujam and Varadarajam (1989), which describe diversification as "the entry of a firm or a business unit into new lines of activity, either by processes of internal business development or acquisition, which entail changes in its administrative structure, systems, or other management processes". The implications of diversification, then, at a first glance, are twofold, i.e. both external and internal to the firm. Indeed, the two perspectives relate to different approaches in explaining firm's competitive advantage, the Structure-Conduct-Performance (SCP) model and the Resource-based View (RBV), respectively emphasizing the external environment and the firm's internal resources and capabilities in determining its success in a certain market.

Similarly, a firm's decision to diversify may stem from either – or both – external and internal factors, i.e. concerning the industry overall and competitive environment (e.g. market is approaching maturity, margins are thinning, technology is becoming obsolete, competition is increasing, new profitable opportunities are discovered) and/or its resources and competencies (e.g. exploiting synergies in the cost structure or in the company's core competencies, hedging risks). Far from being a yes-no question, the matter of diversifying mostly concerns: the direction to pursue, i.e. the markets to tackle and the kind of strategy

to adopt; the operational modes to achieve it, in order to gain the best performance out of it. Although a whole line of research has explored diversification in relation to how it is attained, i.e. through M&A, joint ventures or internal development, for the purpose of this dissertation the focus has been restricted to the discussion about where product diversification is directed, thus also excluding geographical diversification, hereby mentioned as internationalization strategy (see Section 2.3).

On diversification direction and classification, an early seminal contribution to diversification as a growth strategy, dating back to 1957 and still largely used today, was that of H. Igor Ansoff. The father of Strategic Management, Ansoff identified four main growth strategies that a company could pursue (individually or in combination), represented in what then became a common marketing tool, the Ansoff Matrix (Figure 13). These "product-market strategies" are: market penetration, i.e. increasing sales of existing products; market development, i.e. adapting existing products to serve different markets; product development, i.e. devising new products to place in existing markets; diversification, which deals with new products in new markets and represents a separate strategy as it requires the acquisition of new assets, competences or resources (Ansoff, 1957).

Figure 13: The Ansoff Matrix

Building on this, Ansoff identified three kinds of diversification:

- vertical, when it concerns upstream or downstream value chain integration;

- horizontal, which exploits the firm's resources and know-how to develop new products within the same industry;
- lateral, which goes beyond industry boundaries.

Subsequent studies, drawing from the work of Rumelt (1974), explore the degree of relatedness in product diversification, discovering a strong empirical relationship between related diversification and performance. As a matter of fact, Rumelt's classification was a fundamental reference for all further research, as he distinguished between single business, dominant business, related business and unrelated business, based on the percentage of revenues depending on one business. While exploring the impact on performance, Rumelt (1982), further argued that, since diversification implies the absence of market interaction between the products, and thus zero "cross-price elasticity"[5], then the reasons for diversifying are to be found in the exploitation of shared resources. The most-effective degree of diversification then, is the one which "balances economies of scope with diseconomies of organizational scale". Indeed, his empirical analysis shows that firms engaging in related diversification achieve a higher Return on Capital (ROC).

Further studies have supported Rumelt's claim and investigated what does constitute and describe a related business, referring to both internal and external factors. Johnson et al. (2017), as reported by Galpin (2019), identify a well-known inverted U-shaped relationship between the "relatedness" of diversification and performance, where highly diversified companies (or conglomerates) face higher costs and higher complexity in managing the organizational structure (Figure 14). However, research on the matter seems to produce mixed results, with some studies claiming related diversification was indeed superior to unrelated diversification and others finding no significant difference (Shin, et al., 2015). The issue, then, appears to be not merely the degree of diversification of relatedness *per se*, but whether or not companies are able to effectively manage diversified portfolios and actually take advantage of the resulting synergies.

[5] Cross-elasticity of demand is a measure of the market responsiveness in the quantity of one good when the price of another changes. As such, it is useful in determining if different goods belong to the same market, in case they are to some extent interchangeable.

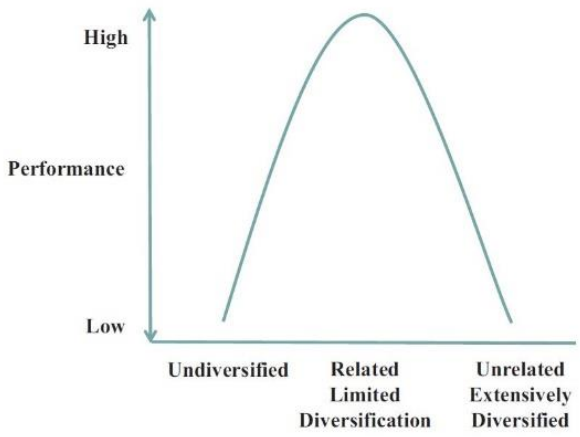

Figure 14: Relationship between diversification and performance (Johnson et al., 2017)

On the matter, the Resource-based View (and then the Competence-based View) provided a much more comprehensive account, incorporating the discourse over internal assets and capabilities into the concept of "relatedness", going beyond the simple product-market level. In fact, according to RBV, a firm is able to successfully diversify if, in doing so, it leverages its internal competencies and assets. Thus, elaborating on the related diversification literature, the concept of corporate coherence was proposed by Teece et al. (1994), indicating a multiproduct firm that is able to generate and exploit synergies of different kinds, not limited to the static notions of economies of scope and subadditivity of cost functions, but including dynamic capabilities, as diversification is a dynamic process (Foss & Christensen, 2001). A coherent firm, therefore, is one that engages in related diversification, has interconnected assets and is able to move into new markets adapting its resource base in a consistent way.

Subsequently, Piscitello (2004) bridges the complementary ideas of business (output) diversification and resource or technological (input) diversification into the concept of corporate coherence, maintaining a dynamic perspective. She proposes a definition based on the "interconnectedness between the output (product/market) and the input (technological competence) side of the story", in order to then estimate the impact of corporate coherence and diversification on performance, however only finding a weak link between the two. Vu and Ha (2019) adopt a similar point of view and explore the link between business diversification and asset diversification, on the assumption that the first entails the need to invest in the latter. Although geographically limited, the study finds that related assets through the mediating effect of related businesses, do have a positive impact on corporate performance. Closer to the subject of this dissertation, Shin et al. (2015) find a similar

linkage by analysing a sample of firms in the Korean telecommunications industry, which engaged in horizontal related diversification by offering IPTV services to their current customers (see Section 2.3.3).

Despite the lack of absolute consensus in the empirical field, the inverted U-shaped relationship between diversification and firm performance has become well-established in the Strategic Management literature, as based on decreasing marginal benefits on the one hand and increasing marginal costs on the other. However, significant variability has been observed between different firms, suggesting that the ability to successfully manage diversification is not equally distributed between firms, but a firm-specific variable (Mackey, et al., 2017). As such, it was also found to be time-dependent, in the sense that degrees of diversification, and especially unrelated diversification, have significantly decreased over time, suggesting that environmental factors and economic conditions play a relevant role in diversification decisions. Even more interestingly, the negative impact of unrelated diversification on performance seems to have declined over time (although not disappearing), implying that there is in fact no easy recipe for diversification, but its effect on performance remains highly firm- and context-specific (Schommer, et al., 2019).

In a nutshell, after decades of research, there is still no blatant understanding or scientific consensus on whether corporate diversification adds or destroys value (Nippa, et al., 2011). However, if firms have heterogeneous abilities to exploit the potential benefits of diversification and different context-dependant chances of succeeding in it, a much more interesting question remains, from a managerial perspective, about how to tackle it. As a matter of fact, tools of Corporate Portfolio Management (CPM), such as the BCG matrix, have become deeply ingrained in business practice, despite criticism from academia (Nippa, et al., 2011).

These instruments rest on the assumption that managing a portfolio of products/markets is comparable to managing a portfolio of financial investments, so that sound cash-generating activities should provide funding for riskier and more innovative investments (Figure 15). Both the popular BCG matrix and its competing followers, e.g. the GE/McKinsey and A.D. Little matrices, are based on the same two components: an internal one, including mission, core competencies and competitive position, and an external one, related to market conditions and attractiveness. The latter, then, largely depends on the life-cycle stage of a product/market, with new and emerging markets generally considered cash-absorbing but

more attractive than mature ones. Put differently, it is a long-held belief in strategic management that highly diversified firms should employ the cash generated by their dominant position in a mature market to invest in innovation, i.e. in potentially profitable future businesses.

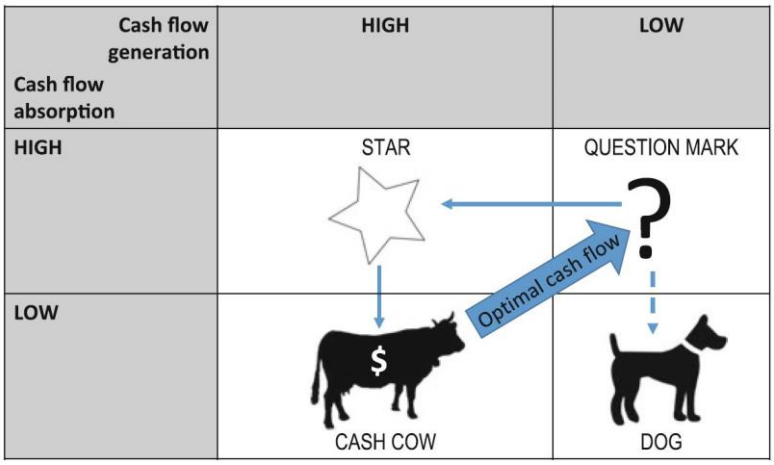

Figure 15: The BCG (Boston Consulting Group) Matrix (source: Cantamessa & Montagna, 2015)

These approaches, however, often criticised for their oversimplification, do not necessarily take into account issues of synergy and relatedness, core competences and shared resources, and how they are actually used in managerial practice can vary significantly, yielding vastly differing results. Therefore, authors such as Galpin (2019) have argued for a "focused corporate parenting approach" to create competitive advantage, suggesting that corporate parenting, i.e. managing diversified product portfolios in a value-adding way, should be developed as a strategic core competence, through professional figures such as portfolio managers, synergy managers and capability developers.

In summary, diversification does not inherently lead to value creation and competitive advantage, as a number of factors intervene in the process of its realization and upholding, both internal and external to the firm and both supply-side and demand-side. It can be, instead, regarded as a potential growth-fuelling tool, with careful considerations to be carried out on a firm-, industry- and time-specific basis, as well as a certain level of risk tied to it like to any strategic decision. Therefore, in the next Section, TIM's strategy with regards to diversification is analysed in an effort to encompass all such factors impacting both on the decision to diversify and on the success of the endeavour.

2.3 TIM's strategy since liberalization

Driven by political will, the process of liberalization of the telecommunications sector and privatization of Telecom Italia in the 1990s posed crucial questions on the development and growth paths for the incumbent to pursue, with a non-neglectable governmental influence dictated by geopolitical interests. In fact, the Italian government maintained a central role in the strategic decisions undertaken by TI, by intervening in the initial but also subsequent company takeovers. Indeed, in the initial phases, the privatization of Telecom Italia was determinant in the country's ability to reduce national debt and meet the criteria to join the European Union. Governments played a key role in each acquisition with the goal of preserving national interests, for example by blocking the acquisition from Deutsche Telekom (controlled by the German State) in favor of the Olivetti group (Kornelakis, 2015).

The involvement of the government, then, directly impacted not only the institutional framework and competitive environment in which the incumbent could move, but also its high-level strategies, as long as it maintained its "golden share" and veto power over acquisitions. The integration of EU markets and deregulation in general opened up growth opportunities in both different geographical and product markets, as telco operators were free to invest and expand their activities in other industries and other countries. Indeed, from the incumbents' perspective, two main growth strategies could be pursued: internationalization and (product) diversification. The first did not exclude the latter, and in fact, to some extent, both were undertaken.

Nevertheless, much like other European countries, the Italian government had an activist role in Telecom Italia's internationalization strategy, in a general race to establish a strong and global "European champion". By the mid-1990s, TI had all the potential to successfully expand abroad and become a major global player, being among the first incumbents in the world for turnover and number of customers (Bulfone, 2019). In the following years, the Group outlined and carried out its strategic plan to expand its operations not only in Southern Europe and the Mediterranean area, but also in the emergent Latin American market; by 2000, it had stakes in several European countries (France, the Netherlands, Austria, Spain, Czech Republic, Serbia and San Marino) as well as in Latin American ones (Argentina, Brazil, Chile, Bolivia, Peru, Venezuela and Cuba), with international operations reaching a 29% of total sales in 2007 (Kornelakis, 2015). However, both in the European and Latin American markets, Telecom Italia found growing competition, that, along with the massive

debt, did not allow for sustainability of the investments and induced a de-internationalization strategy, with the incumbent divesting most of its international ventures – with the notable exception of TIM Brazil – to focus on its internal market.

At the same time, technological advancements led to convergence of the whole telecommunication industry, with the bundling of telephony with Internet services (double-play) and even cable TV (triple-play). In other words, it seemed logical and beneficial for carriers to simultaneously operate in related sectors such as fixed and mobile telephony and Internet connections, insofar as they could exploit the benefits of diversification pertaining to both supply-side and demand-side factors. Such reasoning underpinned Telecom Italia's strategy in the merger with its mobile counterpart TIM and in the development of internal competencies and external partnerships necessary to sell the variety of products and services it offers today, as the industry further converges with its IT neighbor.

Overall, the motivations behind TIM's diversification strategy can be found on the one hand on the internal side, in a search for producer and consumer synergies, i.e. creating additional value and/or reduce costs by employing shared resources, and on the other hand in the careful consideration of the external context. As the latter were explored in Chapter 1, it will suffice to say that product diversification allows for the diversification of risks, especially when facing the threat of a saturated, mature and increasingly competitive market (e.g. the fixed and mobile markets), and the opportunity of innovative, rapidly growing markets (e.g. Cloud Computing). The following sections, hence, explore the concepts of producer and consumer synergies, underlying TIM's diversification strategy, and then offer an overview of how it can be characterized and classified according to definitions provided in the previous Section. Finally, the role of bundling with respect to diversification is discussed, considering the impact it may have on overall performance.

2.3.1 The quest for synergies

2.3.1.1 Supply-side factors

When it comes to diversification choices, it seems most obvious that shared competences and resources on the supply side play a crucial role in the strategic reasoning. To be precise, "supply-side" factors are considered as those which pertain to the construction of the supply, i.e. the resources needed to bring the offered service to the customer. In this sense, supply-side factors of TIM include physical resources (e.g. the network infrastructure),

organizational structures (e.g. sales and R&D functions) and technological competences (e.g. the experience in a certain technological field). It goes without saying, then, as it was discussed from a generic industry perspective, that synergies in these factors have a fundamental role in diversification decisions, especially from the practical perspective of costs. In fact, these synergies have often been referred to in the literature as economies of scope.

Theoretically, scope economies occur when fixed costs are spread over a product mix instead of a single product or service, and in presence of cost complementarities arising from knowledge-intensive and human-based resources, i.e. the skills and competences of human resources that can be leveraged in the provision of a diverse set of products and services. The resulting cost-efficiencies have been found to exist in the telecommunications industry, since significant costs are common to the provision of, for instance, local and long-distance calls, as in a study by Banker et al. (1998). However, the same costs are also shared by, for instance, telephony and Internet services, or fixed and mobile lines: the development and maintenance of the network, customer operations (e.g. sales, customer care, marketing and advertising, etc.) and general corporate expenses (accounting and finance, HR, IT, etc.). The resources related to such costs, then, are exploited by multiple products (or in this case services), so that overall costs of providing two (or more) services jointly are lower than if providing them separately:

$$C(q_1, 0) + C(0, q_2) > C(q_1, q_2)$$

The choice of diversifying, then, is perfectly logical from a merely economical perspective, when analyzing supply-side factors. Indeed, it was an almost obvious move to expand from fixed telephony to Internet services, as the two services are based on the very same infrastructure. On this point, Kim and Kogut (1996) argue that a firm's diversification path follows the technological trajectory of its industry, which in turn is a result of both technological push (internal research, constrained to the firm's current state of knowledge) and market pull (whether or not the technology is actually embraced by the market). In other words, diversification decisions are largely based on the underlying technologies, whose development is path-dependent, explaining why most diversification activities are, in fact, of the related kind and most innovation is actually an aggregation of existing technologies and ideas.

This is especially true for what Kim and Kogut (1996) call "platform technologies", i.e. those technologies which allow for various market opportunities to be exploited. It can be argued that major telecommunication technologies, such as fiber-optic cables, digital switches and radio technologies, and the know-how associated to their deployment, are indeed an example of platform technology. Therefore, mastering one of these platform technologies is likely to lead a firm such as TIM to provide multiple services based on it. A recent example of this is the 5G technology, which can find applications in many different fields and services, the so-called "verticals": from education to transportation, from finance to public safety. TIM's role in these 5G applications is not only that of connectivity provider, but central in the design and provision of the final service, carried out by a network of partners.

2.3.1.2 Demand-side factors

Another more recent stream of research on diversification completely overturns the supply-side perspective analyzed so far. In fact, considerations on demand-side factors derive from the adoption of a customer-centric point of view: relatedness in products or services is not only defined by the underlying supply-side resources or technologies, but is determined by consumer perception as well. In this sense, there are demand-side synergies to be exploited and additional value to create and capture by offering, for example, two apparently unrelated goods (from a supply-side view), which are instead complementary in the eyes of customers. Consumer synergies, in fact, create extra value, as offering related products or services together brings a greater utility to the customer than the sum of individual ones. This kind of synergies can only be achieved with "an intimate knowledge of consumer preferences" (Ye, et al., 2012).

Customers' increased utility deriving from demand-side related diversification, essentially stems from two motivations: "one-stop-shop convenience" and superior customer value. The first relates to benefits earned by customers in purchasing multiple products from the same location (product co-location). This generates both savings for customers, in terms of search costs and times, prices (single-seller discounts), and so on, and additional value, since he/she can enjoy better product complementarities and a better experience in purchasing from a familiar retailer (Manral & Harrigan, 2016). Examples of diversification exploiting this kind of synergies are numerous: the gas-station-convenience-store model so ubiquitous in the USA, with negligible producer synergies, can only be explained by the convenience customers obtain by purchasing groceries while simultaneously filling their gas in the same

place. Another more recent example in dot-com domain is the website that has become itself synonymous with diversified one-stop shopping: Amazon.com (Ye, et al., 2012).

The latter superior-customer-value argument claims that consumers are willing to pay a premium to buy a portfolio of complementary products from one diversified seller, rather than multiple retailers. In other words, as argued by Manral & Harrigan (2016), demand does not remain constant when diversification is carried out, but is instead boosted by it, insomuch as customers are willing to pay more or are more likely to purchase both complementary products if buying from a single seller. Particularly, empirical evidence from the US telecommunication market in the 1990-1996 period supported the claim that demand for two demand-side related services (local and long-distance calls) was increased by joint provision more than it was in areas with two separate specialized providers (Manral & Harrigan, 2016).

In short, demand-side factors refer to all those factors concerning how the customer approaches the offered services, rather than how the firm brings them to him/her. To enjoy consumer synergies, in fact, firms employ demand-side strategic assets which are shared by the different products or services: customer-base, customer-knowledge and customer-relationship (Manral & Harrigan, 2016). These strategic resources are critical for a player like TIM, which indeed strives to provide one-stop-shop convenience to its customers. As longest-lived operator in Italy, its customer-base is certainly the largest among carriers, while its customer-knowledge and customer-relationship competences are clearly among its major resources and capabilities. Therefore, the customer synergies exploited by TIM are vast both in the consumer and business segments, examples of which are the provision of entertainment content for mobile residential users or the supply of even simple IT services (e.g. DNS-level anti-virus, data storage solutions) to Internet connectivity buyers. Finally, customer synergies are harnessed by reselling complementary devices such as smartphones, TVs and tablets, purchased in combination with core services.

2.3.2 Horizontal vs lateral diversification

Both supply-side and demand-side factors play a role in TIM's diversification strategy, which, as mentioned, was – and is – predominantly of the related kind, either from the firm's or the customer's perspective, or both. However, a distinction may be drawn with regards to its direction, between horizontal and lateral diversification activities. TIM's horizontal diversification comprises all services that remain within the boundaries of telecommunications and this is indeed the kind that has prevailed, with the gradual

unravelling of the various fixed and mobile technologies. In this sense, as previously mentioned, horizontal diversification follows the technological trajectory of the industry. As typical of telecommunications, however, subsequent technologies have not substituted previous ones, but resulted in a stratification of infrastructure, so that old technologies often remain in use as additions or alternatives to newer ones.

In the fixed domain, for instance, several connectivity options are available to users (especially business ones) in terms of technology, depending on network coverage but also on customer preferences (e.g. SHDSL, VDSL, ADSL, GBE, FWA), and one may also be used as backup line for another. In the mobile market, instead, each new generation was meant to substitute the previous one and reach universal coverage, so older networks are effectively used as second resort for shortages in newer ones. This is not, however, reflected in how the commercial offer is structured, as consumers usually pay for voice and Internet services regardless of technology, with possible exceptions in the business sector.

More interestingly, nonetheless, is the choice of diversifying beyond industry boundaries, i.e. engaging in lateral diversification. In this case, TIM's activities were mostly directed towards the Media and Entertainment and IT industries, in line with general industry trends. Particularly, TIM has developed TV & Entertainment offerings, initially offered in combination with fixed or mobile plans, but now mostly as stand-alone services, such as TIM Vision, TIM Music, TIM Games and TIM Box, both relying on internally developed platforms and external partners, of the likes of Netflix, Amazon Prime Video and NowTV.

Similarly, for IT services TIM has both acquired internal resources, such as data center infrastructures, and relied on partners and suppliers to provide its services. If in the latter case the incumbent is positioned as a reseller of other firms' services, diversification in the Cloud Computing business represents a more notable lateral effort, as it requires large investments in infrastructures. This move, however, is less surprising in light of the ICT convergence described in Chapter 1: the phenomenon, in fact, is arguably based on the advantage of sharing resources and competences to operate in a neighboring market, both from a demand- and a supply-side perspective.

2.3.3 The role of bundling

Given that offering diversified product portfolios accrues benefits in terms of producer and consumer synergies, telecom operators often choose to do so through the practice of

bundling different services and products together. Theoretically, bundling refers to the strategy of packing two or more products together to gain a pricing advantage. In fact, considering two generic goods, each consumer has different reservation prices (i.e. the price he/she is willing to pay) for each one: r_1 and r_2. Based on this, consumers make different consumption decisions and can be ideally divided into four different categories, depending on the prices set for the two goods (p_1 and p_2): those who buy good 1, those who buy good 2, those who buy both and those who buy none (Figure 16).

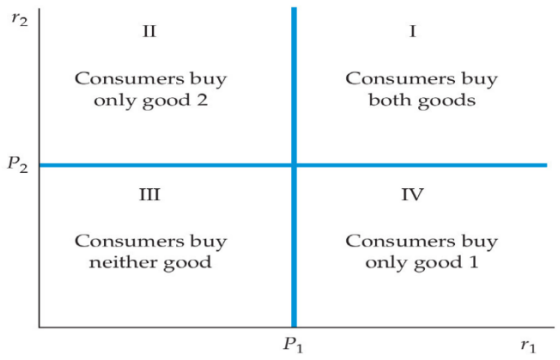

Figure 16: Consumer preferences for two generic goods sold separately

Instead, when the two goods are bundled together and sold at a single price p_B, each consumer will buy the bundle if the sum of his/her reservation prices is greater than the bundle price: $r_1 + r_2 > p_B$. Consumers, then, will simply be divided between those who buy and those who do not buy the bundle (Figure 17). In this manner, the firm is able to capture a larger share of profits, especially when the demands for the two goods are negatively correlated, i.e. when consumers have high reservation prices for good 1 and low for good 2 (and vice versa). Furthermore, bundling can be of two kinds: pure, as in the generic case described, or mixed, when the two goods are sold as a bundle as well as separately at the same time, leaving a wider choice to consumers.

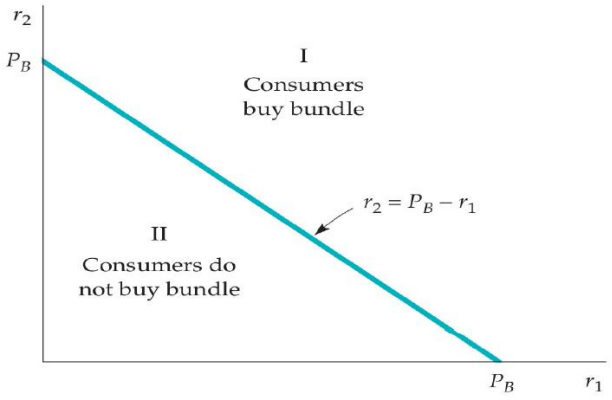

Figure 17: Consumer preferences for two goods in case of bundle

The practice of bundling, in both its pure and mixed form, has been widespread in telecommunications since the early days, for three main purposes: to price-discriminate and extract larger consumer surplus, as so far explained; to reach cost-efficiencies, when there are economies of scale and scope in producing the two goods together; to strategically deter entrance, i.e. exploiting a dominant position in a market to gain advantages in a more competitive one (García-Mariñoso, et al., 2008).

This rationale gave rise to the so-called "multi-play" plans, including at least two among: fixed broadband, television, fixed telephony and mobile services. Bundled offers have continuously increased in all Europe, with BEREC (Body of European Regulators for Electronic Communications) reporting that in 2017 85% of fixed broadband lines were sold bundled, often (75%) with fixed telephony (BEREC, 2018). By means of example, TIM's residential fiber optic connectivity is currently offered bundled with the rental modem, TIM Vision and an extra option, to be chosen among fixed telephony, an additional TV offer, dedicated assistance, a video surveillance system or a security service.

With regards to the impact on corporate performance, Shin et al. (2015) by analysing a sample of Korean telecommunications firms offering fixed telephony, broadband and IPTV, found empirical evidence not only that related diversification positively affects performance from the demand side, but also that such impact on performance is greater in presence of bundling than in its absence. TIM's diversification strategy, then, appears to be motivated by arguments, as explained in this Chapter, rooted in economic theory, factual experience and empirical evidence. Nonetheless, its odds in new target markets are not obvious nor self-evident, especially in a complex new business as Cloud Computing, where it faces strong competition from both global and local players.

Chapter 3: The Cloud Computing Industry

Among the major building blocks that constitute the technological framework of the digital transformation, a focal role is unquestionably assumed by the Cloud Computing paradigm. While as consumers we have become extensively accustomed to everyday cloud-based applications, like emails, online banking or social media, firms are constantly devising new ways to exploit their opportunities and advantages, both in the development of new services and in the enhancement of their existing business processes.

The groundbreaking potential of the Cloud is not nearly limited to outsourcing costly IT infrastructure, but constitutes an enabling platform for all the trending topics of the digital transformation: Artificial Intelligence, Internet of Things, Big Data Analytics, Virtual Reality and so on (Osservatorio Cloud Transformation, 2019). All such technologies, in fact, more and more often find application in cloud environments, where data are available in real time and in massive quantities.

The pervasive reach of cloud technologies is upturning the logic of IT business strategies, whereby firms do not regard the IT function as a cost center anymore but rather treat it as a strategic asset that can pay off in terms of differentiation and sustained competitive advantage. Liberating companies from the burden of huge capital investments, cloud services allow to be flexible and timely in business decisions, while at the same time capitalizing on the most valuable asset of all: information.

From a macroeconomic perspective, the adoption of the cloud computing paradigm can produce competition-enhancing effects, as its scalable and on-demand nature narrows the gap between large and small firms in their potential to implement state-of-the-art innovations. If, then, the cloud transformation appears like a forced path for both multi-billion-dollar companies and SMEs on the demand end, how the supply side of the story will evolve is a much more complicated question to answer.

This Section seeks to address such question, first by outlining what does compose the paradigm (and what does not), secondly by assessing the market potential of cloud services in Italy (demand-side perspective) and thirdly by evaluating the competitive scenario for Cloud Service Providers (supply-side perspective).

3.1 What is Cloud Computing

3.1.1 Definition

While the concepts behind it are hardly new ("computing as utility" was a concept first imagined in the 1960s), the expression "cloud computing" has only recently become a buzzword on everyone's lips. A clear and broadly accepted definition is provided by the American NIST (National Institute for Standards and Technology): *"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."* (NIST, 2011)

The shift in paradigm is driven by the idea that processing and storing data in large server farms can dramatically increase efficiency with respect to in-house solutions, as the resources – or at least the facility – are shared between multiple clients and the Cloud Service Provider (CSP) can thus enjoy vast economies of scale. In order to achieve efficiency, three core technological concepts are necessary and underpin the paradigm: virtualization, multitenancy and web services (Marston, et al., 2011).

First breakthrough to shape the cloud computing model, virtualization was conceived and realized by VMware, which launched its first hypervisor in 2002, the ESX Server 1.5. This revolutionary software is able to split one physical hardware system (a server made of CPU, storage and memory) into multiple simulated environments, called Virtual Machines (VMs), that remain logically separated, distinct and secure. Additionally, modern hypervisors are able to allocate physical resources to VMs in a dynamically efficient way, while allowing users to easily configure them on demand. Virtualization, then, results in a much higher utilization of the computing infrastructure, leading to far lower investment and operation costs.

As a result, the same physical resources can be safely shared by multiple customers, whereby different instances of the same software are created and executed to accommodate different users, each with their own dedicated interface, resources and services (multitenancy). For instance, different companies can use entirely separate VMs on the same server to host their websites or applications and make them available to the intended users over a network. In

particular, web services are the software that allows for the connection of clients and servers over the Internet, ensuring interoperability between different software systems and creating a so-called Service-Oriented Architecture (SOA)[6]. Similarly, in the private domain, an enterprise Information System may be accessed by its users (e.g. the employees of a firm) over a MPLS network[7].

Still, as established by NIST (2011) and consolidated in industry knowledge, the cloud computing paradigm is defined by five essential characteristics:

1. On-demand self-service: customers can procure themselves computing capabilities, which are automatically provided without the need for human interaction with the CSP;
2. Broad network access: computing capabilities are available and accessed over the network through standard mechanisms (e.g. HTTP, TCP/IP protocols) to different kinds of client platforms (smartphones, laptops, tablets, etc.);
3. Resource pooling: the provider pools together computing resources and assigns them dynamically and automatically to multiple tenants, according to consumer demand;
4. Rapid elasticity: computing capabilities can be elastically and rapidly scaled up or down, sometimes automatically, to meet demand;
5. Measured service: resource utilization is optimized, controlled and measured by a metering capability of the cloud system; it is usually associated with pay-per-use or change-per-use pricing models.

Despite the unambiguous definition offered by NIST, the expression "cloud computing" is often misused – on purpose or not – to simply describe Internet-based services or other kinds of architectures that do not possess all the listed characteristics. This phenomenon has been referred to as *cloudwashing*, i.e. the deceptive use of the "cloud" label in what is often a mere rebranding of legacy services. As a consequence, navigating the waters of cloud computing services is quite complicated for unexperienced or uninformed adopters, as even assessing what actually is or is not cloud computing is not necessarily straightforward.

[6] A Service-Oriented Architecture is software architecture that supports a collection of services communicating with each other.
[7] A MPLS network (i.e. a network based on the Multiprotocol Label Switching technique) is an IP-based, completely private network, equivalent to the Internet, connecting different sites of a business customer.

3.1.2 Cloud Computing Architecture and Service Models

A cloud computing architecture is typically made of three layers with different levels of abstraction: infrastructure, platform and application (Figure 18). The first layer is the physical one, which comprehends the hardware components at the base of the whole system, namely: computing, storage and networking. While they can assume different configurations depending on the actual products employed, all are necessary and always present. First of all, servers, i.e. computers that *serve* data to other computers, provide the computing power (CPU and RAM). Secondly, storage systems are essentially hard drives that can be directly attached to the single server (DAS), connected to it through the network (NAS) or available through a network of all storage devices (SAN)[8]. Finally, networking refers to all components responsible for the connection of servers and storage systems with each other and with the outside world, including routers, switches, firewalls, bandwidth and network management software. These may be in the form of Local Area Networks (LAN), Storage Area Networks (SAN) or Wide Area Networks (WAN).

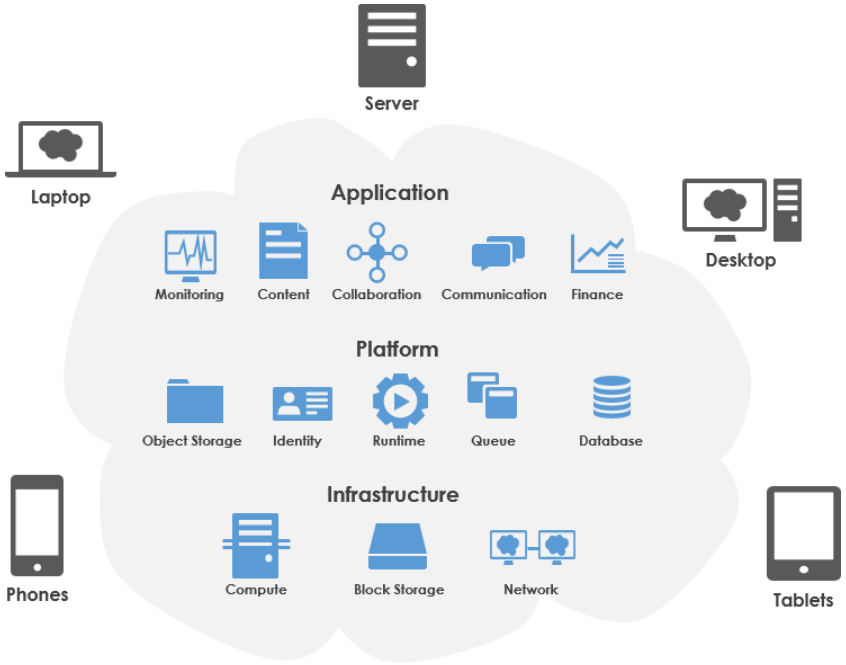

Figure 18: Layers of a Cloud Architecture

The cloud computing architecture, in its three layers and various components, can be managed by the provider or by the customer to different extents. In fact, depending on how much of the cloud system is provider-managed, different service models are offered to

[8] The three acronyms stand for: Direct Attached Storage(DAS), Network Attached Storage (NAS) and Storage Area Network (SAN).

clients, namely IaaS, PaaS and SaaS models (Figure 19). Infrastructure-as-a-Service (IaaS) models provision the necessary computing resources (datacenter space, servers, storage, networking and virtualization software), so that the customer can deploy and run his/her own software, from the Operating System (OS) to the final applications. The basic unit of service, therefore, is the Virtual Machine, with certain CPU, RAM and storage specifications depending on user need.

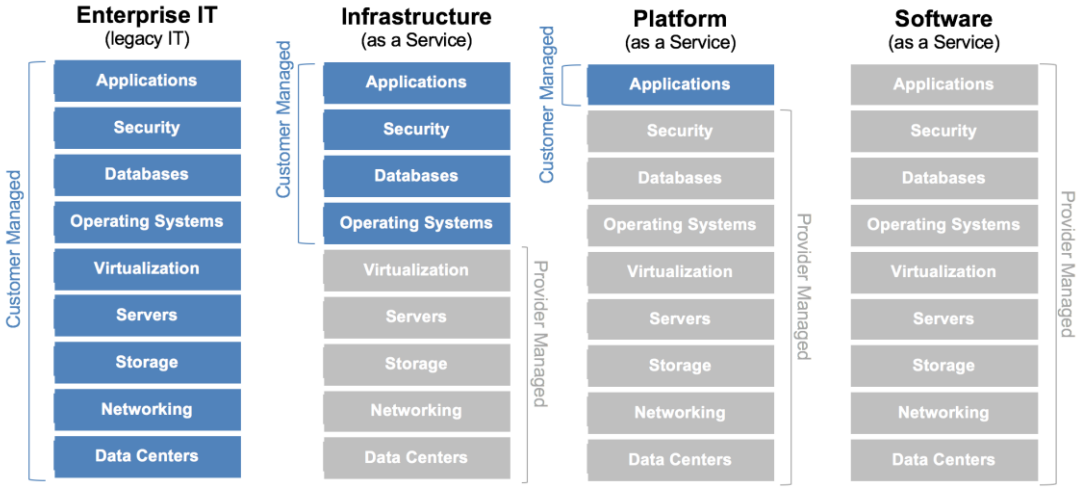

Figure 19: IaaS, PaaS and SaaS service models

Platform-as-a-Service, instead, refers to an intermediate service model, which offers a dedicated environment for the customer to develop, test and deploy his/her own (or acquired) applications. Specifically, the provider manages and maintains all system software on top of the physical infrastructure, from the operating system to database and integration software and other features, so that the client is facilitated in writing and developing applications. Finally, the Software-as-a-Service model is the one we, as consumers, have the most familiarity with: it offers users the capability to use the provider's application, which runs on a cloud infrastructure rather than on each client device. The application software, then, is available to users over a network – the public Internet or a private network – and accessible on different devices through a user interface, often a web browser.

As it seems self-evident, the three main service models have different levels of customer involvement in the management of the architecture, decreasing from IaaS to SaaS models. Furthermore, each one is intended to serve different categories of users and purposes. First, IaaS services are targeted at IT administrators, with the aim of reducing costs by migrating legacy software to a cloud infrastructure, instead of relying on internal resources and competences. Notable examples of such services are: AWS Elastic Compute Cloud (EC2)

by Amazon; Google Cloud Platform's Compute Engine; Azure Virtual Machine by Microsoft. Second, PaaS services are meant to be used by software developers, or the company's IT department in general, which wish to be eased of the responsibility to update, upgrade or install patches to the software. Examples of PaaS services are: Heroku, AWS Elastic Beanstalk, Azure App Service, Google App Engine. Lastly, the SaaS model directly delivers applications to end users, offering services spanning from productivity tools (e.g. Office 365, Google Docs, Outlook, Gmail) to various management software for businesses, such as CRM and ERP products (e.g. Salesforce.com, Hubspot, SAP).

3.1.3 Deployment models and migration paths

Besides the essential characteristics and service models of cloud computing, NIST (2011) describes four deployment models: Private, Community, Public and Hybrid Cloud. A *private cloud* ensures the firm complete exclusivity over the infrastructure employed, so that the physical and/or virtual resources are dedicated for its use. Still, according to the formal definition, the cloud infrastructure "may be owned, managed and operated by the organization, a third party or some combination of them, and it may exist on or off premise" (NIST, 2011). Therefore, an organization may choose to rent datacenter space, dedicated computing resources and networks, or even realize its own infrastructure without any CSP. The latter case, in fact, is still defined as (private) cloud computing, as long as it follows the logic an on-demand flexible service for its internal clients: resource utilization is optimized for use by different corporate departments and, for instance, VMs may be provisioned elastically according to the need of each one. Similar but less widespread, community cloud is a kind of private cloud in which the infrastructure is dedicated to a group of organizations that share the same goals or interests, and respects the logic of cloud computing in serving different entities of the group.

Nevertheless, the most archetypical deployment model for cloud computing is that of public cloud, because it allows for the largest economies of scale and cost savings. In public cloud models, CSPs cater their services to the general public, in the sense that they can be rented by anyone. They do so by building, operating and maintaining an infrastructure consisting of a whole network of datacenters, typically dislocated all over the world, so that customers can use applications already available for use (SaaS) or develop/migrate their own (PaaS or IaaS). As opposed to private cloud, the infrastructure is not dedicated to a specific client but shared by many, however still maintaining complete logical separation among different

customer instances by means of virtualization. As a consequence, public cloud models are generally more efficient than private ones, especially for large volumes of data, yet do not guarantee the same levels of security delivered by dedicated infrastructures, in which clients always knows where their data are located.

Clearly, then, the choice between the two is dictated by trade-off decisions that deal with security issues on the one hand and cost effectiveness on the other. The need to comprise one or the other underpins the concept of the fourth deployment model, hybrid cloud, which is essentially a mixture of the two: different cloud infrastructures (public, private or community) "are bound together by standardized or proprietary technology that enables data and applications portability" (NIST, 2011). A hybrid model may be deployed both as a definitive solution and in a transition logic. In the first case, the rationale is that of enjoying the benefits of each model for different business goals and, in fact, a very common practice for firms is that of retaining critical data and applications (those which represent core assets of the company) in a private environment while moving newer and less sensitive ones to a public cloud. However, a firm may also find itself in this in-between situation while transitioning to a full-public cloud infrastructure, as the process of migration is not immediate nor uncomplicated.

As a matter of fact, the strategic choice of a deployment model is tightly related to decisions over migration paths, i.e. the strategies to adopt in order to migrate existing corporate applications (legacy) to a cloud environment. The literature has consolidated a distinction between four possible migration paths: *Lift & Shift*, *Replatforming*, *Refactoring* and *Repurchasing* (Figure 20). A *Lift & Shift* (or *Rehost*) strategy does exactly what the name suggests: it migrates a legacy application as-is to a IaaS cloud environment with only minor adjustments, requiring the minimum effort from the organization but also preventing it to take advantage of most benefits of cloud computing. *Replatforming* consists in a greater manipulation and optimization of the legacy application in order to move it and adapt it to a new PaaS environment. *Refactoring* further impacts the existing application, which is recoded and redesigned to be cloud-ready for a IaaS or PaaS environment, in order to fully exploit the benefits of cloud computing's elasticity and flexibility. Finally, *Repurchasing* is not effectively a migration strategy but rather the decommissioning of a legacy application in favor of a new cloud-based SaaS application (Osservatorio Cloud Transformation, 2019).

The four migration strategies can be understood in terms of the degree of effort (both economic and organizational) as well as competences (software development and operation) they require from organizations, but also with respect to the reward of said effort. In fact, if in the first case the migration requires lesser costs and capabilities, it is far from the modularity and scalability of *cloud-native* applications and all the related benefits. In this sense, a *Lift & Shift* strategy appears as a more conservative, diffident and short-term tactical decision, rather than long-term and strategic like a *Refactoring* one. Still, a cloud migration process needs to take into account not only strategic goals and objectives to attain, but technologic and organizational constraints, such as the characteristics of the applications to migrate on the one hand, budget/time limits and IT skills on the other. Overall, the choice of a deployment model over another and that of the appropriate migration strategy is determined by such strategic considerations based on the understanding of where the firm starts from and where it wants to go. For the rest, it crucially depends on the firm's propensity to take risks, innovate or rather be conservative and cautious.

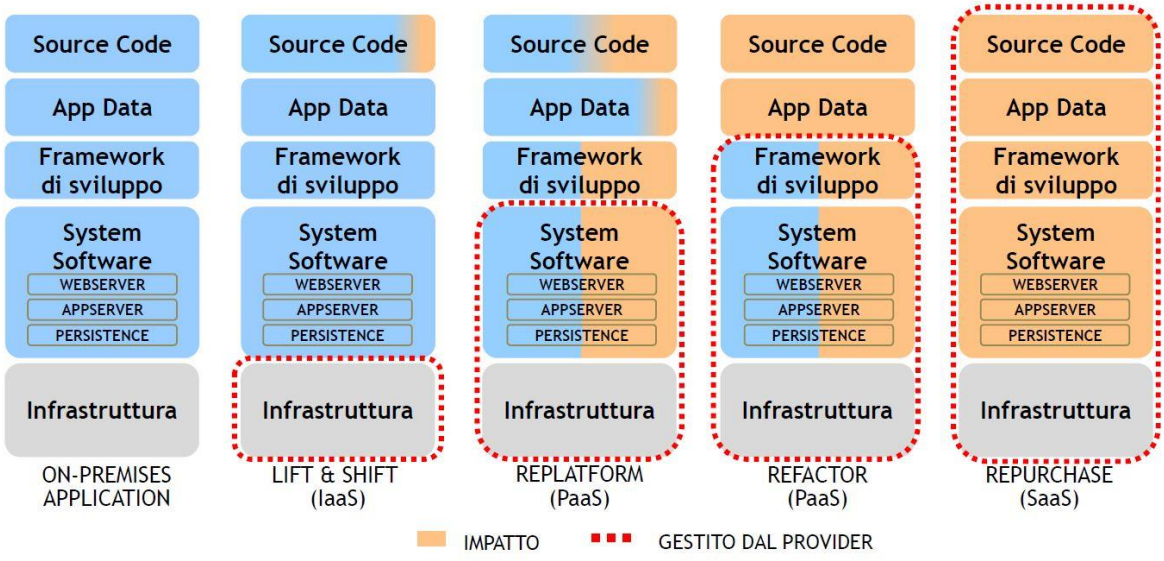

Figure 20: Migration strategies (source: Osservatorio Cloud Transformation, 2019)

3.1.4 Latest international industry trends

Confirming the interpretation of migration strategies outlined in the previous paragraph, Osservatorio Cloud Transformation (2019) identifies a *New Migration Wave* as one of the main trends of the international cloud computing scenario: firms are changing their strategies from the Lift & Shift path to an increasingly cloud-native logic, both in the recoding of

existing application or directly in newly purchased or developed applications. The state-of-the-art paradigm for cloud-native applications is based on the concepts of microservices, serverless computing and containers, which ultimately cater the mentioned modularity and flexibility of cloud-based applications.

First, Microservices Architecture represent an evolution of SOA (Service-Oriented Architecture), in which an application is composed of a combination of a number of small independent services, such as the shopping cart of an e-commerce website, constructing the software with fine-grained loosely coupled building blocks rather than monolithically. This eases the development process by allowing modularity, scalability and ultimately more rapid and frequent software releases. Containers, instead, allow to package application in a virtual space which is independent of the underlying execution environment, so that they can be easily moved and deployed. In other words, containers operate a virtualization at the level of the Operating System on top of the virtualization of hardware resources which creates Virtual Machines.

Finally, Serverless Computing refers to a model of PaaS public cloud in which the CSP is solely responsible for the infrastructure, which scales automatically and is not even visible to the customer. As a consequence, software developers (to which the service is addressed) do not have to worry about provisioning and configuring the infrastructural layer but simply about coding functions that operate independently– in fact, such scheme has been referred to as FaaS (Function-as-a-Service). Pricing, then, is an extreme version of the pay-per-use model, as it occurs every time an instance of the software (i.e. the functions) is actually executed. Overall, the trend is that of increasing abstraction of the applications with respect to the underlying hardware infrastructure, to reach higher efficiency in development and operations, increasingly carried out simultaneously (e.g. DevOps methodologies).

The employed cloud computing architectures also point to the direction of increased flexibility, in order to effectively respond to ever-changing economic and technological needs. In fact, IT strategies are increasingly moving towards models of Open and Distributed Cloud, in which legacy on-premise systems coexist with both public and private clouds creating complex hybrid architectures (Osservatorio Cloud Transformation, 2019). Particularly, Multi Cloud models, i.e. Hybrid models with more than one CSP, seek to avoid the lock-in effect, by exploiting the benefits of different cloud environments through a platform that is able to integrate and connect them dynamically. A further element of

complexity in the cloud computing world is the emergent trend of Edge Computing, which seem to row in the opposite direction of the cloud paradigm itself: distribution instead of centralization. This responds to specific needs of low latency (for real-time computing) related to applications like Internet of Things and Industry 4.0. All in all, cloud computing is growing in complexity as older and newer models coexist, serve different purposes and impact firms' business models and investments.

3.1.5 The economics of Cloud Computing

Before cloud computing, firms were essentially forced to purchase, install and maintain all the equipment necessary to build their own private datacenter (DC). Besides the necessary human resources to operate the infrastructure, IT spending in a company has always been a capital-intensive long-term investment, especially at times when physical resources were far more expensive than today. Furthermore, it often represented a kind of Capital Expenditure (CAPEX) not directly associated with business objectives, but actually absorbing portions of budget that could otherwise be devoted to business expansion.

Over time, as the technological scenario evolved and the strategic importance of IT began to be recognized by firms, improving efficiency was a strongly felt issue in IT departments, striving to keep costs down. The reason for inefficiency was to be found in a major shortcoming of private datacenters, even with the advent of virtualization (which turned them in virtualized datacenter): underutilization. Strikingly, most datacenters were filled with servers bought for a specific purpose at a given moment, but usually ran at 5-10% utilization. Still, virtualization did bring about an estimate of 20-30% cost savings (Microsoft, 2010).

From an economic perspective, the cloud computing paradigm is again – and even more than before – tranforming how companies think of IT spending. Cost savings for customers, in fact, are substantial and originate from large economies of scale enjoyed by providers, which, in turn, arise in three areas: "supply-side savings", "demand-side aggregation" and "multitenancy-efficiency" (Microsoft, 2010). The first refers to the lower costs per server that can be obtained by a cloud provider operating large datacenters. In fact, on the one hand cloud providers can spread fixed costs over many customers, namely labour costs (as several management tasks are automated) and expenses for security and reliability of the infrastructure. On the other hand, CSPs usually pay lower unit prices both for equipment and electricity: the first because of standardization and quantity discounts from suppliers (up to

30%), the latter by purchasing in bulk and choosing sites with low electricity costs to build their DCs (Microsoft, 2010).

"Demand-side aggregation", instead, refers to economies of scale deriving from improving utilization of the infrastructure, i.e. by evening out sources of variability in demand. In fact, capacity utilization is highly variable for a number of reasons: randomness in end-user access patterns; time-of-day patterns (certain services are mostly used in certain hours of the day); industry-related variability (e.g. peak usage during holiday season for retail industries); multi-resource variability (some services require more CPU than storage or vice versa); uncertainty in growth patterns (difficulty in predicting future use often generate underutilization). Cloud Service Providers, by means of diversification, can level such instances of variability, for example by allocating two complementary services (e.g. mostly used in opposite times of the day or different seasons) on the same machine (Microsoft, 2010).

Finally, CSPs can exploit multitenancy of applications to achieve further economies of scale. In fact, in multitenant SaaS services such as Office 365 multiple users can share the same instance of the application, thus allowing the provider to amortize on a large userbase the fixed costs related to it: application management labor costs, which are fixed regardless of userbase; costs related to the fixed component of server overhead (i.e. that part of server utilization which does not vary depending on the number of users). Overall, Microsoft (2010) estimates a 80% reduction in Total Cost of Ownership (TCO) thanks to the economies of scale so far outlined.

This has two major consequences for firms' budgeting and financing of IT. Firstly, as it is evident, it significantly decreases expenditures, especially those necessary to maintain existing infrastructure and applications, which often constitute the larger share (Microsoft, 2010). In turn, such cost savings free up monetary resources which can not only be invested in business-related activities (i.e. in other corporate functions) but also within the IT department to develop new innovative applications and services. Secondly, cloud computing has the strategic advantage of turning Capital Expenses (CAPEX) into Operating Expenses (OPEX) by means of a subscription-based spending. As a consequence, companies gain the necessary flexibility to operate in fast-moving competitive environments, as their ability to increase or decrease capacity is no longer constrained by discontinuous investments, but can more fluidly follow the actual workload.

3.2 Demand side

With IT and digitalization themes assuming a focal role in business discourse, cloud computing finds applications in virtually every sector of the economy. Specifically, the Italian market registers conspicuous growth in all compartments and especially in the banking, insurance, services and manufacturing sectors (Figure 21). The latter is also the first one in terms of expenditure (25% of Public and Hybrid Cloud market), followed by banking (20%), Telco and Media (15%), Services (10%), Utility (9%), PA and Healthcare (8%), Retail and MMR[9] (8%), Insurance (5%) (Osservatorio Cloud Transformation, 2019).

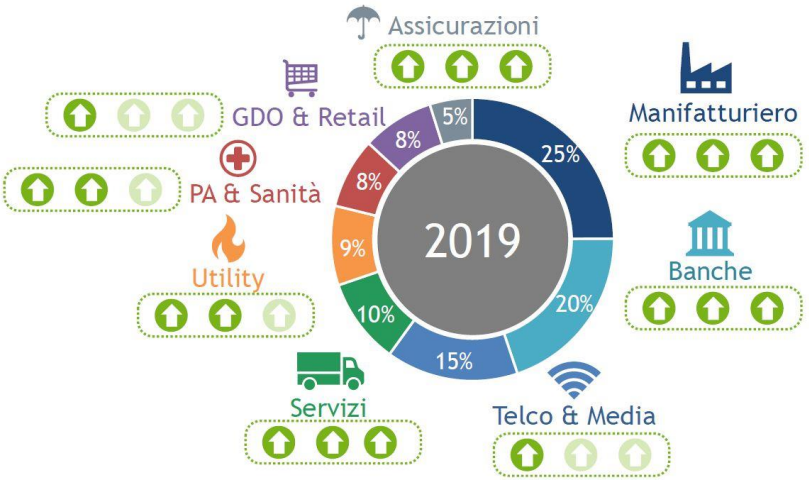

Figure 21: Breakdown of expenditure in Public & Hybrid Cloud per sector (source: Osservatorio Cloud Transformation, 2019)

Cloud Computing currently powers a number of applications and uses both for consumers and businesses: data storage and backup, online education, video and audio streaming, communication tools, just to name a few. However, its disruptive potential reaches even higher levels as a "Digital Enabler" for new technological trends like Artifical Intelligence, Big Data Analytics and Internet of Things. These technologies, in fact, require high performances and computational capacities, which are easier to achieve using state-of-the-art cloud computing services rather than developing internal infrastructures (Osservatorio Cloud Transformation, 2019). However, the cloud transformation is a process still in the making in the Italian market, driven by certain factors and hindered by others. The following paragraphs explore such factors, in order to assess current adoption and demand for cloud computing services.

[9] Mass Market Retailers

3.2.1 Key advantages and drivers of cloud adoption

Most of the key benefits of cloud computing *per se* were already mentioned in previous paragraphs: cost-efficiency, flexibility, scalability and so on. Generically, from the perspective of an adopting firm, the advantages of fully or partially switching to a cloud model are both tangible and intangible. Tangible benefits are essentially about cost reduction, considering cut or avoided costs in all phases of an adoption process: investment in infrastructure; waste related to over-allocation of resources; investment in a Disaster Recovery (DR) system, readily available in cloud computing services; operating and personnel costs to run the infrastructure (rent, utilities, etc.) as well as periodic updates and upgrades of both hardware and software; reduced costs associated with downtimes (higher availability and reliability). Therefore, cloud computing services grant greater economic sustainability in the long run (Osservatorio Cloud Transformation, 2019)

However, not all benefits of the cloud are economically quantifiable but constitute, instead, strategic advantages related to business agility and innovation. First, as already mentioned, freed up budget can be channelled towards core competences and innovative projects, to seize new business opportunities. On this regard, cloud computing substantially lowers barriers to innovation, as large IT investments are no longer necessary and complex data analytics and business intelligence tools are now available even to small firms. An example in plain sight is the continuous blossoming of Internet startups to which we have become accustomed (Marston, et al., 2011). Furthermore, the very own characteristics of cloud computing make businesses more agile, as they allow for rapid creation of Proof of Concepts (PoCs), reduced time-to-market and thus increased competitiveness. In fact, the Osservatorio Cloud Transformation (2019) reports that 82% of firms believes that cloud computing increases IT agility and another 82% expands this belief to the whole company, deemed more flexible to innovate and respond to market changes.

3.2.2 Risks and doubts about adoption

Industry observers often argued that cloud adoption in Italy has been slower than in other countries due to a general skepticism of Italian firms towards the new paradigm. In fact, at least in the eyes of potential adopters, cloud computing implies new risks and added costs. First of all, a struggle encountered when advocating for cloud services within the firm, is that of correctly estimating the economic benefits: 35% of firms cite it as main difficulty in cloud adoption (Osservatorio Cloud Transformation, 2019). As it was discussed in the

previous paragraph, advantages of cloud computing are not merely economic but, even more so, of a long-term strategic nature. Therefore, adopting an entirely new computing logic may entail a surge of costs in an initial phase, primarily in relation to change management and human resources. On this regard, 66% of firms perceive the need to develop cloud-specific competences, through partnerships, recruitment or professional training, while 58% declare to struggle in finding such competences in the job market.

Besides the need to acquire competences and capabilities, cloud computing urges firms to also adopt new organizational structures and practices such as DevOps and Agile methodologies. Furthermore, the cloud raises the need to implement a Cost Management and Accounting system, to monitor and govern consumption of the service and allocate it to different corporate functions (Osservatorio Cloud Transformation, 2019). Another difficulty, which translates into increased costs, is that of drafting and evaluating contracts with CSPs, as they are complex to understand without the proper know-how and at the same time more standardized, leaving a lower bargaining power to clients.

Along with economic issues, the most cited difficulty (35%) in cloud adoption by Italian firms relates to compliance (and security) issues (Osservatorio Cloud Transformation, 2019). On this regard, Italian firms have long been reluctant in entrusting themselves to CSPs, as they feared they could not effectively control data location, proper processing and security, especially with respect to critical business applications and non-EU CSPs. However, last year's EU General Data Protection Regulation (GDPR), despite raising complexity in the management of security measures (especially for Hybrid and Multi Cloud environments), is generally acting as a push factor on demand for cloud services. In fact, its aim is essentially that of increasing data protection and prevent data breaches, by assigning liability and enforcing obligations on the data processor, i.e. the CSP (Russo, et al., 2018).

Furthermore, GDPR extends the territorial scope of its predecessor (DPD) to extra-EU ones "that process or monitor personal data of subjects who are in the EU" (Russo, et al., 2018). In this sense, cloud services are often more secure than traditional on-premise solutions, as CSPs already employ GDPR-compliant data protection measures and have accesses to state-of-the-art cybersecurity tools that not even large firms can reach on their own. Still, perception of security issues is evolving together with increasing cloud adoption, as more and more firms are realizing the benefits of the cloud model even with regards to security and compliance.

Overall, the decision on cloud adoption depends on a firm-specific balance of costs and savings, as well as strategic advantages and disadvantages. In other words, the convenience in switching to cloud computing strongly depends on the specific case and each firm's starting point. However, this idiosyncrasy is greatly reduced for greenfield projects (i.e. brand new applications) as opposed to migration of legacy software, for which it is often deemed more convenient to stick to hybrid or more traditional solutions (Osservatorio Cloud Transformation, 2019).

3.2.3 The Cloud Transformation in Italy

According to Gartner (but also widely recognized), the US has been leader in cloud adoption since 2015, with over half of global spending ($140.4 billion expected in 2020), followed by other "tracking", "lagging" or "resisting" countries (Gartner, 2019b) (Gartner, 2019c). In this scenario, some European countries are framed in the first category (UK, Poland and the Netherlands), whereas others are positioned in the second group, including Italy (Figure 22).

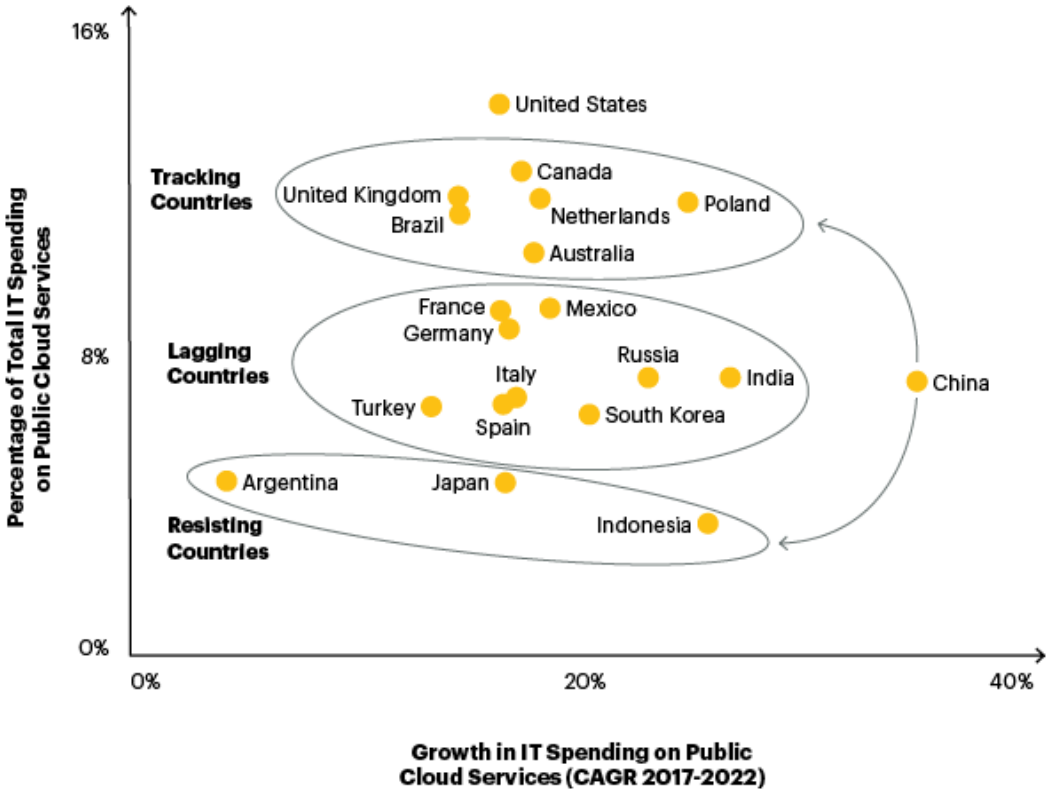

Figure 22: Worldwide cloud adoption (source: Gartner)

As a "lagging country", Italy is just now reaching market maturity in cloud computing, with an overall market value of €2.77 billion, growing 18% YoY (Osservatorio Cloud Transformation, 2019). Spending can be broken down in two major directions: one regarding

outsourcing services, further decomposed into Public & Hybrid Cloud and Virtual & Hosted Private Cloud, and another concerning the transformation of internal Information Systems to make them cloud-ready, i.e. the expenditure in Datacenter Automation & Convergence. Of these, the largest cut (€1.56 billions) and the fastest-growing share (+25%) is that Public & Hybrid Cloud, testifying the gradual overcoming of skepticism towards cloud services (Osservatorio Cloud Transformation, 2019). Virtual & Private Hosted Cloud and Datacenter Automation & Convergence follow, respectively with €661 (+11%) and €550 (+10%) millions. Still, the whole market is seeing a substantial and fast growth trend (Figure 23).

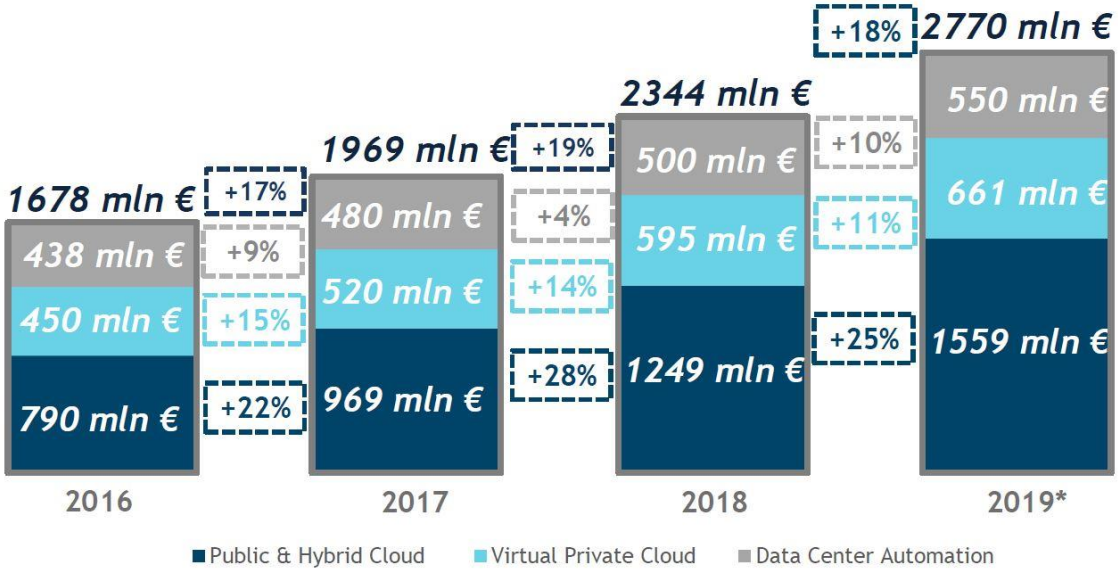

Figure 23: Cloud market value growth trend in Italy (source: Osservatorio Cloud Transformation, 2019)

In particular, within the Public & Hybrid Cloud component, SaaS services represent the largest share (44%), amounting to €689 millions (+22% YoY), followed by IaaS services, with €625 millions (40%, +24% YoY). PaaS services remain the smallest segment (16%), however registering the highest growth (+38%) and reaching a size of €245 million (Figure 23). In fact, trends of AI, Big Data Analytics and Serverless Computing point to the gradual shift of software development from IaaS to PaaS environments, to exploit state-of-the-art functionalities present in PaaS services. SaaS growth, on the other hand, is driven by AI software and PEC services, thanks to the new obligation of electronic invoicing, effective since 2019 (Osservatorio Cloud Transformation, 2019).

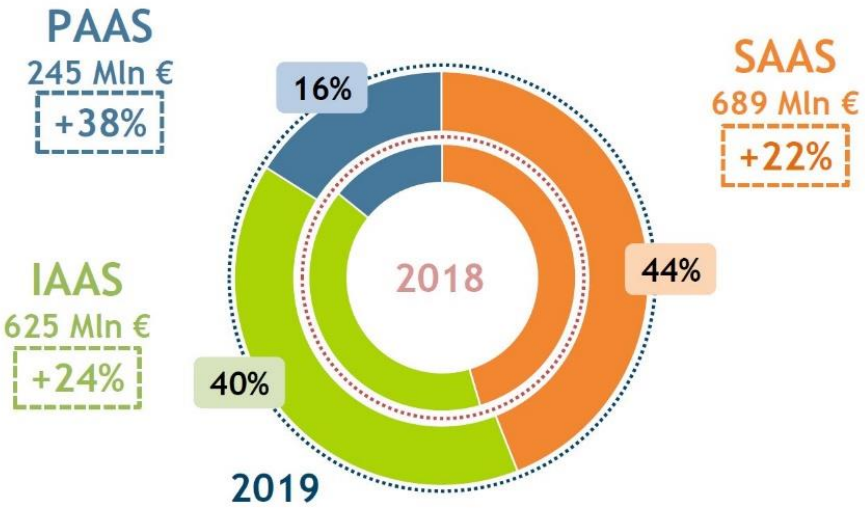

Figure 24: Expenditure in IaaS, PaaS and SaaS services

An interesting distinction to be drawn for cloud adoption is that between SMEs and larger firms. As one could imagine, large firms are leading the adoption of cloud computing, with 84% using public cloud services as of 2019. Furthermore, 41% of the sample declares to use it extensively for core processes and 51% for support processes. SMEs, on the other hand, are only recently starting to move to the cloud, with 63% of the sample still not using and not interested in it. However, a growing share is using (22%), experimenting (8%) or considering cloud services for the future (7%). Particularly, the cloud is indicated as preference for future digital projects in 38% of cases, obligated choice in the 11% and evaluated case-by-case in 29% (Osservatorio Cloud Transformation, 2019). It could be stated, then, that SMEs represent the segment with the largest market penetration potential for CSPs, as they still have much room for cloud adoption and are moving in that direction.

Furthermore, the previous paragraph mentioned a difference in cloud adoption for greenfield and legacy projects. Survey data support this thesis, revealing that for new projects only 13% of large firms chooses a traditional on-premises strategy, 45% opt for a selective case-specific strategy, whereas 31% have a Cloud First strategy and 11% even a Cloud Only strategy. As for legacy software, most firms are evolving towards a hybrid model (54%), while 30% are migrating or have already migrated to the cloud and 16% will stick to traditional on-premises. The market, then, seems to point in the direction of mixed, case-by-case strategies, as firms still do not believe to possess all the necessary competences for the cloud transformation and most of the times resort to external consultants to manage the process (Osservatorio Cloud Transformation, 2019).

As for migration strategies, survey data highlight that the greatest opportunities are for SaaS and IaaS CSPs. In fact, Repurchasing is the most chosen strategy, employed by 68% of firms for support applications rather than mission critical ones. Lift & Shift, then, is used by 45% of the sample to contain costs and impacts on the business. Refactoring and Replatforming, instead, are used respectively by 41% and 40% of firms and generally only for core applications, because of the greater effort required.

Finally, Hybrid and Multi Cloud models are becoming more and more established, with 77% of firms adopting a hybrid ecosystem. As for Multi Cloud specifically, firms recognize its benefits and actually 68% of firms hire more than one cloud provider (3 CSPs on average per firm), but still lack the ability to manage different cloud services in a sinergic and integrated way (Osservatorio Cloud Transformation, 2019). In other words, the market clearly shows a demand for orchestration services of Multi Cloud environments, through platforms that allow to grasp all its perceived advantages.

3.3 Supply side

If demand for cloud computing services is in continuous expansion, supply from both Italian and international CSPs is striving to keep up the pace of the growing Italian market. In fact, minor and major players are increasing their capacity by building new datacenters, diversifying from one segment to another (e.g. from IaaS to SaaS services), expanding their service portfolios and experimenting new solutions with cutting-edge technologies like AI and machine learning.

As the market approaches maturity, equilibria between actors become more stable and market structure more evident, converging towards greater consolidation. In other words, market leaders are reinforcing their role in the different segments, but there is still much room for upturnings and adjustments. The following paragraphs describe the major players, both international and Italian, to assess the competitive scenario and market structure for the provision of cloud computing services.

3.3.1 Major worldwide providers and international context

As the US market was the first to develop and thrive in cloud computing, it comes as no surprise that almost all major worldwide CSPs are, in fact, American. Indeed, along with the demand-side of the market (greatest cloud adoption), the USA are leading in the supply chain for cloud services, both in commercial and technological terms. Specifically, Amazon's

AWS is currently the undisputed market leader for cloud computing, with a 32% market share in 2018 according to Canalys (2019).

Amazon Web Services (AWS), the subsidiary that was launched in 2006 by the e-commerce giant, essentially invented the business model for cloud computing as we know it, described in Section 3.1.1. The platform itself was born in 2002, initially conceived to accommodate internal business needs for greater efficiency and eventually used to offer web services and virtualized servers to the general public. In this sense, the birth of cloud computing at Amazon seems to be a mixture of strategic vision and corporate needs, with the concepts of scalability and virtualization at its roots. As of 2006, AWS offered only three basic services: Simple Storage Service (S3), Elastic Compute Cloud (EC2), Simple Queue Service (SQS).

Today, AWS counts over 165 cloud computing and web services, that respond to all sorts of business needs by offering integrated IaaS and PaaS solutions with a variety of additional services such as CDNs (Content Delivery Network), container services, serverless computing, etc. Furthermore, AWS has the largest global presence, with 69 Availability Zones (AZs) and 22 geographic regions all over the world (each regions comprises at least 2 AZs) and announced 13 more AZs and 4 new regions, one of which will be centered in Italy near Milan (AWS, 2019). With such a vast worldwide presence and advanced offering, AWS accounts for 58% of Amazon's total revenues as of 2018 (CNBC, 2019).

Because of its first-mover advantage, AWS is now the most mature cloud provider, with the longest operational experience, top-notch security measures and the widest network of customers and parnters. In fact, AWS boasts numerous success stories, customers of any industry and size, both innovators and conservatives, which tend to make longer financial commitments to Amazon and entrust it with more mission-critical workloads (Gartner, 2019a). Also, AWS has the largest and most engrained partner ecosystem, including system integrators and Independent Software Vendors (ISVs). Finally, Amazon has so far kept on pioneering new services at an unmatched pace, so that it can offer its customers the most advanced services regarding AI, machine learning, IoT and serverless computing, with over 40 services that are not offered by any other CSP and 1,957 new features released in 2018 (AWS, 2019). Nevertheless, Gartner (2019a) points out that since AWS strives to be first to market with new releases, added functionalities often need subsequent development and updates.

Despite not reaching AWS' level (according to industry experts), other tech giants have long tapped into the cloud computing business with enormous success and double-digit growth rates. An overview of major worldwide CSPs, their estimated revenues, market shares and growth for full-year 2017 and 2018 is provided in Figure 25 (Canalys, 2019). Second-best after AWS is Microsoft, which holds a strong presence in the IaaS/PaaS market with its Azure services, as well as an established in leadership in several SaaS segments, such as for productivity software (Office 365). Azure offers many of the functionalities and advanced services of AWS, while providing seamless integration between IaaS and PaaS components. Furthermore, Microsoft is exploiting its capillary sales reach (Office products suffice as example) to increase its market penetration in IaaS and PaaS markets. However, customers complain about reliability issues (Microsoft has suffered several outages since 2018) and about the quality and cost of technical support (Gartner, 2019a).

Vendor	2018 (US$ billion)	2018 Market share	2017 (US$ billion)	2017 Market share	Annual growth
AWS	25.4	31.7%	17.3	31.5%	+47.1%
Microsoft Azure	13.5	16.8%	7.4	13.5%	+82.4%
Google Cloud	6.8	8.5%	3.5	6.4%	+93.9%
Alibaba Cloud	3.2	4.0%	1.7	3.0%	+91.8%
IBM Cloud	3.1	3.8%	2.6	4.7%	+17.6%
Others	28.3	35.2%	22.4	40.8%	+26.1%
Total	**80.4**	**100.0%**	**54.9**	**100.0%**	**+46.5%**

Figure 25: Worldwide Cloud Computing Market Shares, revenues and growth in 2017-2018 (source: Canalys Cloud Channel Analysis, February 2019)

With a focus on IaaS services, Gartner (2019a) classifies top global CSPs according to two dimensions: completeness of vision and ability to execute. Absolute leader, once again, is AWS, which excels at both and in 2018, in fact, conquered an overwhelming 47.8% of the global market. Microsoft Azure follows with lesser operational excellence and a much smaller market share (15.5%). Other major players are: Alibaba Cloud, with a specific strong presence in China, Google Cloud, which is growing astoundingly at 93% YoY, and IBM Cloud.

Company	2018 Revenue	2018 Market Share (%)	2017 Revenue	2017 Market Share (%)	2018-2017 Growth (%)
Amazon	15,495	47.8	12,221	49.4	26.8
Microsoft	5,038	15.5	3,130	12.7	60.9
Alibaba	2,499	7.7	1,298	5.3	92.6
Google	1,314	4.0	820	3.3	60.2
IBM	577	1.8	463	1.9	24.7
Others	7,519	23.2	6,768	27.4	11.1
Total	**32,441**	**100.0**	**24,699**	**100.0**	**31.3**

Figure 26: IaaS service providers' revenues, market shares and growth in 2017-2018 (source: Gartner, 2019a)

3.3.2 Italian providers

Although not comparable in size, many Italian providers compete with multinational CSPs in different segments of the Italian market, with datacenters located in the national territory. Among these, besides TIM (whose position will be analysed in detail in Chapter 4), Aruba is the longest-lived of major players. Active since 1994, it was the first Italian IT company to offer datacenter and web services, both in the IaaS and SaaS markets, and it now counts 5 million customers and 100,000 m^2 of datacenter space, with 3 active proprietary DCs in Italy, one in Czech Republic, another one in construction in Rome and 4 partner-owned DCs all over Europe. As such, it offers its clients experience in the field, a European network of datacenters and a number of services which are specific for the Italian SaaS market, such as Digital Identity, PEC and electronic invoicing.

Another relevant competitor for TIM is Irideos, an ICT company born out of the merger of four carriers (Infracom, KPNQwest Italia, Mc-link e BigTlc), currently operating in both the cloud computing and telecommunications industry with 15 DCs and 30,000 km of fiber optic cables all over the peninsula. The firm seeks to become the third major telecommunications hub, by offering integrated cloud computing, TLC and cybersecurity solutions. Other significant market players often come from the telecommunications sector, such as Fastweb and Tiscali, the first with over 8,000 m^2 of datacenter space and the latter with 4 DCs, whose Data Processing Center (DPC) in Sardinia counts over 7000 m^2.

3.3.3 Competitive scenario in Italy

The Italian market for cloud computing on the supply side appears to be as variegated as the services offered. As previously explained, the sector under analysis comprises an assortment of solutions depending on the infrastructures and competences of the provider, ranging from IaaS to SaaS offerings (indeed, quite different in nature). Similarly, the overall sector is largely fragmented, with different companies active in the different segments and many firms entering the market, operating in niches or at a modest scale. In other words, the cloud computing market still retains a rather competitive configuration (at least in comparison to telecommunications), as it is evident from the examination of overall market shares.

As Figure 27 shows, Microsoft reaches a dominant position (20.6%), largely thanks to its ubiquitous Office 365, Amazon and TIM follow (respectively 13.5% and 9.7%), while all other providers grasp smaller shares (below 7%). Furthermore, the consideration of the CR4 Index, described in Section 1.2, allows to approximately assess concentration levels when complete information on all market actors is hard to retrieve, as in this case. Accordingly, a value of the index of 50.5% reveals a loosely oligopolistic market structure, or a monopolistic competition.

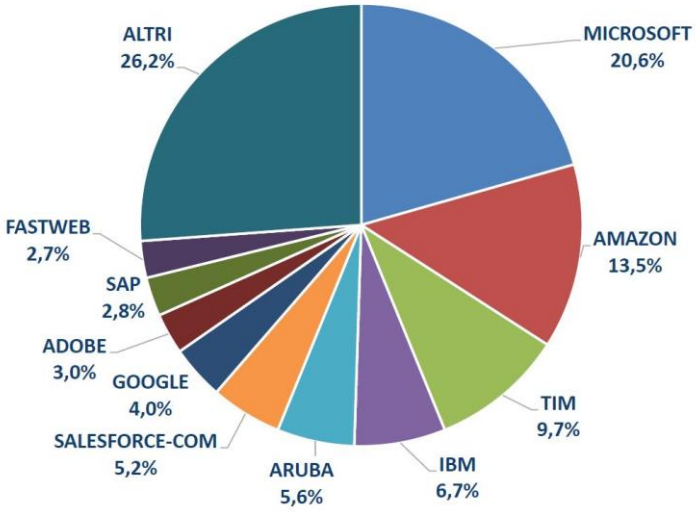

Figure 27: Market shares in the Italian cloud computing market, 2018 (source: Sirmi, 2019)

However, as the cloud computing market is profoundly diverse, information on aggregate sales data is hard to interpret and of limited significance: it is more worthwhile to separately consider the three different components. First of all, the IaaS segment is characterized by greater concentration than the overall market, with Amazon in the lead (24.6%), followed by Microsoft (13.7%), TIM (12.5%) and IBM (9.7%). In fact, the 60.5% CR4 Index reflects

the market structure of the international context, although to a lesser extent (worldwide CR4 is 75%, see Figure 26), with individual segments generally presenting more oligopolistic structures than the total market.

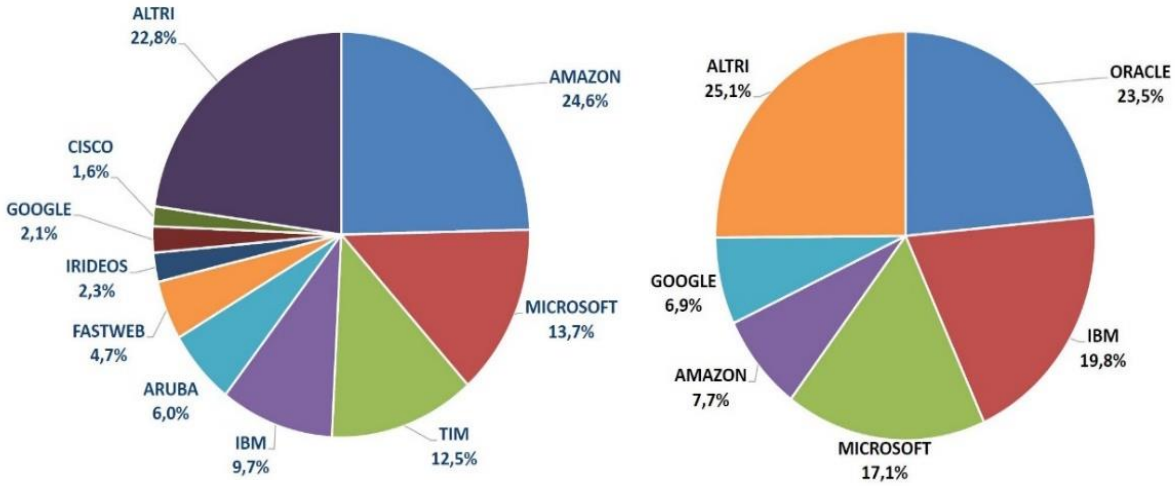

Figure 28: Market shares of IaaS and PaaS segments (source: Sirmi, 2019)

Indeed, the Italian PaaS segment is even more concentrated than the IaaS, with a CR4 Index of 68.1%, as it rapidly grows out of its initial niche dimension (Figure 28). In particular, Oracle (23.5%) and IBM (19.8%) stand out with a dominant position: the first, originally active in the database sector, is currently one of the largest software houses in the world; the latter, longest-lived IT company, offers products and services in nearly every sector of the ICT industry (software, hardware and IT services). The SaaS segment, instead, is once again dominated by Microsoft (29.5%), whose presence is hard to match, and second-best is Salesforce.com (12.2%), world leader in cloud-based CRM services and enterprise cloud computing. In general, besides Microsoft, the SaaS segment is characterized by a wider variety of services and firms, some specialized (or mostly known) in specific market subsegments – Salesforce.com in CRMs, SAP and Zucchetti in ERPs, Adobe in creativity and graphics software – others of a more diversified nature, such as TIM, Google and Aruba.

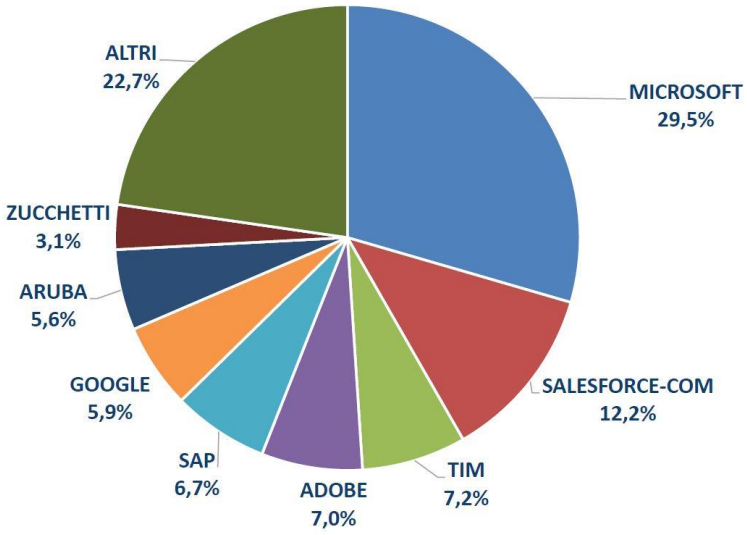

Figure 29: Market shares of SaaS segment (source: Sirmi, 2019)

Overall, with the Italian market in rapid expansion, each provider has the possibility to carve out a space for itself, without resorting to price competition or market stealing. In fact, services are still quite differentiable, for instance by offering additional security measures and certifications in the IaaS segment (e.g. the Tier Classification System of the Uptime Institute[10]), by developing a cloud-based software that responds to a specific business need or by providing consultancy and managed services. However, with large CSPs rapidly growing, the worldwide scenario seems to follow a trend of consolidation, which will – sooner or later – be more noticeable and substantial in Italy as well.

On the one hand, as resources become increasingly abundant and cheap, infrastructural services are starting to move towards commoditization and, because of economies of scale, oligopoly is regarded as the likely outcome for such services in the future, with only a few vendors offering standardized services at low prices in large centralized DCs. On the other hand, current market trends also seem to point in the opposite direction: Multi Cloud, from buyers' perspective, diversifies the supply chain and avoids lock-in, leaving room for multiple suppliers in the mix; edge computing and distributed architectures are quite the opposite of centralization and economies of scale, responding, instead, to specific needs (low latency and quick response).

Still, if the market (and the IaaS segment in particular) will eventually settle as an oligopoly, Italy for the time being has yet to see a definitive configuration. Infrastructural services vary

[10] The Uptime Institute is the main global standardization institute for datacenters, defines criteria for properly designing, building and operating DCs. Its Tier Classification System represents the most trusted and renowned certification for DCs in the world, with four levels (Tiers) of growing redunance and availability.

in redundancy, quality and security levels (top-of-the-range Tier IV datacenters are not that widespread), and it seems that cloud services in general are and will be used to serve very different and possibly discordant purposes. The cloud computing market, then, could remain greatly varied in nature, compatibly with its foreseeable role as underlying foundation of the future digital economy as a whole.

Chapter 4: TIM's diversification strategy in Cloud Computing

Previous chapters explored the complexity of the ICT market landscape with a focus on the Italian market, considering the increasingly interconnected and convergent IT and telecommunication industries. TIM's role in it, as major telecom incumbent is multifaceted, as it is active in the whole range of market segments, from the oldest most traditional technologies to the latest and most innovative. If this is a unique opportunity that no other firm in the industry can boast, at the same time it entails the insurgence of possible threats from multiple sources. Still, thanks to its size and ubiquitous national presence, it has the possibility of strategically directing its efforts towards the most promising markets, responding to such threats and exploiting internal assets and capabilities.

On the one hand, it cannot miss the opportunity to innovate in its core business, i.e. the telecommunications market, and in fact, as it was mentioned, it is currently on the forefront for the development of 5G networks. On the other hand, like other telco carriers, it is shaping its strategic role in the digital transformation, facing competition from new competitors such as OTTs. In fact, European operators virtually have three possible approaches before themselves in terms of positioning: Smart Utility, Platform Enabler or Diversified Service Provider (TIM, 2018). Smart Utilities are focused on infrastructural network services, optimizing costs and operating like any other utility. Platform Enablers realize platforms for new digital services, thus entering new markets with higher added value. Diversified Service Providers, instead, are able to grasp the opportunities of adjacent markets through acquisitions or joint ventures, thus diversifiying broadly and quickly.

While carriers like Telefonica, Orange and Vodafone have chosen a position between Platform Enablers and Diversified Service Providers, TIM had, until recently, focused on a Smart Utility strategy, leveraging its infrastructural assets and capabilities. However, it is now in the process of transformation towards a full Digital Telco, aspiring to be a Diversified Provider and a reference point for Italian firms, especially for high-value-added services. In this strategical framework, the cloud computing business is undeniably central, just as much as it is fundamental for advancements of the whole industry (see Chapter 3).

Therefore, the present Chapter analyses TIM's position in the market, by piecing together the considerations and evaluations illustrated in previous Chapters, to ultimately offer an interpretation of the studied phenomenon. Particularly, this objective is pursued first through a descriptive overview of the assets employed, the services offered and the results obtained,

and finally through an argumentative evaluation of the motives of the strategic choice, the levers for competitive advantage (with respect to competitors) and the possible shortcomings, concluding with a (speculative) outline of future prospects.

4.1 TIM in the Cloud Computing market

TIM's decision to diversify in the Cloud Computing business did not come abruptly, but was instead more of a gradual process that partly reflected the evolution of the industry itself. In fact, first approaches towards cloud-like services were attempted around the turn of the millennium, when Telecom Italia started to offer add-on IT services based in its DCs on top of its connectivity services (then called Full Business Company). However, the market was evidently not mature enough for these services – namely rented datacenter space – that went substantially underutilized. In the 2000s, in fact, TIM essentially offered hosting services (housing and colocation) in its DCs, serving as what was then called Application Service Provider (ASP) and in a market yet rather far from the cloud computing paradigm as defined in Chapter 3.

The turning point in the industry and in TIM's strategy was the advent of virtualization in 2010. In fact, the new technology marked a strong discountinuity for service providers like Telecom Italia, as it allowed to offer (virtual) hosting services to many more clients with the same infrastructural investments (see Section 3.1.1). As a consequence, Telecom Italia launched its first massive investments in physical infrastructure and platforms, as well as the first advertising campaign for the "Nuvola Italiana". Nonetheless, these services were still quite basic and did not allow for the rapid flexibility that would become core in the cloud computing paradigm, internationally developed in the same years.

It is only around the mid-2010s that TIM's supply evolved towards an on-demand model, where the client can configure VMs on its own and easily scale them up or down. Throughout the years, then, TIM has enriched its infrastructure and its service portfolio in relation with cloud services, growing to be one of the leading Cloud Service Providers in Italy. Therefore, the following Sections describe the present infrastructure, the currently offered services and latest economic results, to frame TIM's position in the studied market.

4.1.1 Datacenter infrastructure

Similarly to other CSPs, TIM first built its infrastructure of servers and datacenters to accommodate internal needs, subsequently expanded and enhanced it in order to offer

computing as a service to other firms. The current infrastructure is made of 8 datacenters all over the country and 4 "*Centri Servizi*" (CS): the first offer infrastructural services to business clients, whereas the latter host services and applications directly provisioned to customers. DCs and CSs are carefully dislocated on the national territory (Figure 30), with different sizes but all with high international standards in the construction and operation of facilities, in order to guarantee first-rate availability and reliability.

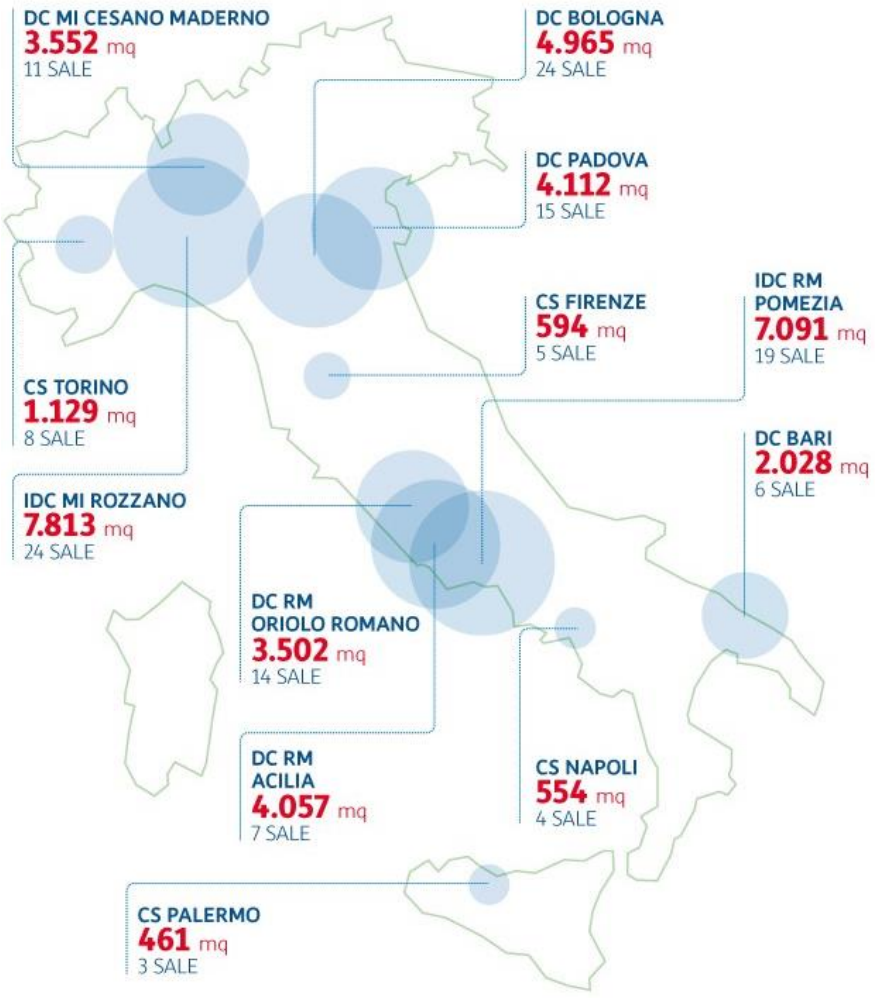

Figure 30: Distribution of TIM's datacenters on the national territory (Source: TIM Netbook, 2019)

All DCs are connected with one another through high-capacity fiber optic rings, realizing a dedicated Virtual Data Center Network (VDCN). In particular, two major hubs are established in the Rome and Milan areas, with two DCs in each one strictly connected with each other (they constitute a *metropolitan campus* with low latency): Rozzano and Cesano Maderno near Milan; Pomezia and Acilia near Rome. Such arrangement allows to realize Business Continuity (BC) architectures where VMs are replicated distributed in the two DCs of each campus, so that if any of the two is out, all services continue to operate

flawlessly on the other. VMs, then, can be further replicated in yet another DC in order to protect them in Disaster Recovery (DR). Then, if any natural catastrophe occurs in the geographical area of the campus and both DCs are down, service can still stay up.

At the level of the single DC, continuity is guaranteed by redundancy of the cooling system and of electricity provision, as well as fire-fighting systems and physical security of the facilities. Particularly, Tier III DCs guarantee a 99.99% availability (45 min per year of downtime) and Tier IV reach the 99.995% (15 min per year). As for connections to external networks, each DC is connected to 2 entirely different POPs (interface with the OPB network) through high speed Ethernet connections in high availability configuration, acheiving the highest standards of performance and redundancy. Furthermore, the two largest sites, Pomezia and Rozzano, are Internet Data Centers (IDCs), because they realize the connection to the public Internet, respectively in the Rome and Milan area.

Particularly interesting is also the structure of networking within the datacenter, which is currently evolving towards a model of Software-Defined Data Center, insomuch as the main DCs are already realized in this manner or are evolving into it. Software-Defined Networking represents the state of the art with regards to datacenters: it essentially separate the network into an underlay and an overlay component, with the first consisting in physical devices forwarding packets (e.g. switches in a spine-leaf architecture) and the latter being the *orchestrator* of the network. This software layer, in fact, is the "brain" of the network and realizes routing operations and allows to automate network configuration activities that are traditionally done manually on each piece of equipment. Such instrument, for instance, is able to automatically set up a network in respondance to a client's instance loaded in TIM's internal systems.

Overall, TIM's offer in IaaS cloud computing is backed by a rich and well-connected infrastructure of datacenters all over the national territory, of which the most important ones employ recognized and certified state-of-the-art technologies. Moreover, the structure and geographical distribution of the datacenter network in a way reflects that of the OPB network (Figure 31): it is shaped according to the computing needs of the country, i.e. near the two strategic clusters of firms and PAs, Rome and Milan. Therefore, thanks to direct connections to its backbone and the structure of the whole DC network, TIM can grant its clients high-speed transmission, redundancy, high availability and reliability and even complete fault-tolerance of the service (through BC and DR). Indeed, it could be argued that the control of

both infrastructural components (network and DCs) is a strategic asset that other providers do not possess and allows TIM to offer high levels of service thanks to a total control of each service layer and its experience in the management and maintenance of complex architectures.

Figure 31: Map of the Optical Packet Backbone (source: TIM Netbook, 2019)

4.1.2 Offered services

TIM's presence in the cloud computing industry is articulated in both infrastructural services (IaaS) and a large number of cloud-based digital services, available as SaaS. The latter include a share in the consumer segment, notably Entertainment products (TIM Vision, TIM Music, TIM Games and TIM Box) and a significant stake in the business segment. Particularly, for enterprises, TIM offers over 150 standardized and ready-to-use IT services on its self-service platform (TIM Digital Store), which respond to an extensive range of business needs: productivity tools, cybersecurity and videosurveillance, billing solutions, CRM and management software, web design and online marketing, e-commerce and so on.

The platform also comprises a limited set of pre-packaged off-the-shelf infrastructural solutions, such as online-configurable storage or virtual servers.

However, the bulk of IaaS sales is realized with more advanced and complex services, which may be customized and typically target larger clients. On this regard, TIM's offering is structured in three main groups of solutions: Housing and Hosting; Virtual Hosting; Data Protection. The first is the first-born, simplest kind of infrastructural services, which essentially allows the customer to rent either datacenter space (colocation) or servers (hosting), in terms of physical resources. Indeed, it could be argued that this kind of services does not fully satisfy to the logic of cloud computing, as resources cannot easily be scaled on demand. Still, it represents a relevant share of the IaaS business, for customers who are not confident yet in the cloud and its advantages.

The second category, Virtual Hosting, is based on the concept of virtualization explained in Section 3.1.1. In fact, in services such as "Hosting Evoluto", TIM offers Virtual Machines rather than physical resources, however still retaining control over the overall architecture. More recent services of the same category ("Self DC") allow greater flexibility and autonomy to the customer, who can adjust parameters of VMs on an predisposed console. In this case, resources are provided for a monthly fee or on consumption, either shared or dedicated. Finally, additional solutions of the third category concern the protection of the client's data and services, by offering backup solutions, as well as the previously mentioned BC and DR.

The most innovative and advanced service, then, in the cloud computing offering, is TIM Multi Cloud. In fact, following industry trends and market demand, TIM is able to offer a governance platform, called Cloud Management Platform (CMP), that visualizes and controls the whole cloud architecture, including on-premise infrastructures, TIM Cloud (one of TIM's IaaS services) and environments provided by major CSPs such as AWS, Azure and even SaaS services. All these different components, in fact, can be visualized in their architecture, monitored, cost-controlled and audited for security and compliance. Furthermore, through the platform the customer can check effective usage and eventually scale capacity up or down. Overall, the offer comprises services that respond to different and connected needs: design and setup of cloud architectures; consultancy in any phase of cloud adoption; managed services (outsourcing of IT monitoring and management); cost optimization, monitoring and efficiency (e.g. thanks to automated workload management).

The development of the Multi Cloud service, then, through the acquisition of assets (the CMP) and competences, reflects a precise strategic choice of TIM, in an effort to follow the latest market trends and effectively respond to a market need.

4.1.3 Economic results

The diversification in the cloud computing business has been yielding consistent economic results for the TIM group. In fact, in a year of mixed results as 2018 (see Section 2.1.4), revenues in IT services have been growing steadily and driving overall revenue growth, compensating declining trends in other segments (e.g. mobile), as discussed in Chapters 1 and 2. This dynamic is particularly evident in the business segment, which realizes the bulk of total industry sales: in the last quarter of 2018 business ICT revenues grew 15% YoY, reaching €217 millions, thanks to a strong contribution of cloud computing services to PA (inserire fonte FY18 results). More recent data confirm the trend for ICT revenues with a 15.7% growth YoY for the second quarter of 2019 (inserire fonte relazione investitori halfyear).

Within ICT revenues, the sale of ICT products represents the larger share (roughly 20%), but cloud services constitute the growth-driving segment, with a CAGR of 23.6% in the 2016-2018 period and a YoY growth rate of 25% for the second quarter of 2019. Particularly, in the same three-year-period cloud computing revenues kept on increasing in all types of services, including public, hybrid and virtual private cloud services. The leading segment is the IaaS, particularly for medium-large firms, with a 30% CAGR, whereas the segment of smaller firms still sees a predominance of SaaS services, as one could expect. Overall, fastest-growing SaaS revenues have outweighted IaaS in the total for 2018, while the share of PaaS still remains marginal. Interestingly enough, though, IaaS services have been booming in the smaller firms segment, rather than in the large firms one, with a 39% CAGR for 2016-2018 (source: internal data).

As for competitive positioning, Section 3.3.3 explored the overall Italian scenario. As it was seen, TIM has reached a prominent position (9.7%) in the overall market after market leaders Microsoft and Amazon, thanks to its diversified activity in all segments (mostly IaaS and SaaS). In fact, TIM is the third provider by market share in both IaaS (12,5%) and SaaS (7,2%), while the presence in the PaaS market is still not significant, although growing in the business compartment. Interestingly, without the share of Microsoft Office, TIM is leader in the whole business segment with a share of 11.1% in 2018. However, with or without

Office, the share in overall business cloud computing market has slightly declined in the last three years, possibly a sign that established international players are further penetrating the market (source: internal data). Overall, although competition with the overseas tech giants is nearly impossible to beat (namely Amazon's AWS in the IaaS and Microsoft Office in the SaaS market), TIM's stake in the Italian market is strong thanks to its nation-specific experience and competence.

4.2 Evaluation of TIM's strategy and competitive positioning

As it was discussed in Chapter 2, TIM and previously Telecom Italia have been pursuing a diversification strategy at least for the last two decades. This was initially dictated by Telecom Italia's role as former monopolist, as it was for quite some time the only carrier with the ability to innovate and deploy new technologies (for its size and resources). In this sense, Chapter 2 argued that TIM's horizontal diversification followed the technological trajectory of the industry and the reasons that motivate it appear obvious: it would have made little sense to stick to an outdated technology or remain anchored to the fixed market when mobile usage was booming.

Less obvious is the choice of lateral diversification, i.e. the choice to expand the business beyond the telecommunications industry. In fact, given a common premise of commoditization of TLC, it is not a given that incumbents would choose to diversify, and indeed some major European firms rather opted for a Smart Utility profile or a milder, more focused diversification as Platform Enablers (TIM, 2018). Still, as connectivity further loses its inherent value in favour of whatever travels on top of it, most incumbents like TIM keep look for opportunities of grasping more value and provide higher-added-value services. In a way, such strategy could be intended as the use of financial resources coming from cash-cow markets (dominant position in a mature market) to invest in new promising businesses ("Stars" in BCG's matrix).

In particular, TIM's choices clearly move towards related businesses, namely diversifying into the Media and Entertainment and the IT industries. The choice of Cloud Computing is, then, very evidently a kind of related diversification, based on the exploitation of shared resources and capabilities (both demand-side and supply-side) with existing businesses. Indeed, it looks even less like a lateral move considering that boundaries between these industries are more than ever blurred (see the concept of ICT convergence described in Section 1.3.3) and networking itself is moving towards software-defined architectures.

Strikingly, the very word “cloud” comes from TLC, when operators started to offer VPNs and were able to dramatically increase bandwidth utilization, such as what the cloud does for computing power (Jadeja & Modi, 2012). A similar convergence discourse stands for the Entertainment industry, where Internet is in the process of completely taking over other mass media (like TV or radio) and entertainment increasingly happens online on cloud-based platforms.

As for cloud computing specifically, its similarity with telecommunications are self-evident: it is a business of high fixed costs and low variable costs, with a similar need to increase efficiency and utilization of the costly infrastructures; key success factors are the availability and reliability of services, as well as cybersecurity, assistance and maintenance. Still, although cloud computing is related and similar to telecommunications, even more crucial is TIM’s ability to exploit synergies to adapt in a new context, since success in diversification depends on firm-specific dynamic capabilities (see Section 2.2).

In fact, the two industries do not share several factors. For instance, telecommunications are the most prominent example of network externalities, which are not that present in cloud computing: the utility of a cloud adopter does not increase if other clients choose the same provider. If anything, in IaaS, relying on an large CSP with many clients grants advantages in terms of costs, partners ecosystem and number of services, but these are actually not network externalities. In SaaS these can be found in some services, but in terms of individual user rather than business customer: it is convenient for consumers to use a standard word-processing application like Microsoft Office Word or Google Docs, while the same is not necessarily true for enterprise applications.

Further differences can be found in market structure, as the cloud computing one is more fragmented, less consolidated and less oligarchic, with many players coming from very different businesses: Amazon from e-commerce, Microsoft from software, Google from Internet services and so on. Moreover, as for the time being, the cloud industry in Italy is also less regulated: relevant regulations all concern data protection, such as the GDPR mentioned in Section 3.2.2. There is, in fact, no specific authority that oversees prices and competition in the industry. Operating in such an environment is thus easier in one way, but challenging with regards to competition. Overall, the two markets share some aspects and differ for others, although they are generally understood as related businesses, both from the

suppliers' and customers' perspective. In this sense, TIM's diversification strategy grants both producer and consumer synergies, as is further analysed in the following Section.

4.2.1 Motivations and sources of strategic advantage

TIM's diversification strategy in the cloud computing market is driven by a number of considerations that pertain both to exogenous and endogenous factors. The first, as outlined in Chapter 1 and 3, essentially relate to the contexts under consideration *per se*, i.e. the telecommunications and cloud computing industries. As it was seen, traditional telecommunications services have undergone a process of commoditization which, along with increasing competition in the latest year, squeezed margins and revenues for all existing carriers. It seems logical, then, that merely analysing the environment and its future prospects, TIM would diversify into a booming market such as cloud computing, which is also less oligarchic, less regulated and with competitive logics still to become consolidated.

A similar reasoning stands within the cloud computing market, where basic IaaS services like Virtual Machines are already turning into commodities and higher Customer Perceived Value[11] is instead to be found in PaaS, SaaS (e.g. business apps, verticals), managed services such as monitoring, cost optimization, security and compliance. In fact, conscious of this market trend, TIM aims at positioning in the side of the spectrum with higher added value, through its Multi Cloud service and consulting activity. In a way, the choice of relying on other major CSPs and use their environments represents a discontinuity for TIM, which has historically strived to present itself as an stand-alone alternative rather than a system integrator. Similarly, TIM's video entertainment offer currently aggregates several external services such as Eurosport Player, Chili, NowTV, Amazon Prime Video and Netflix, alongside or within proprietary platforms TIM Box and TIM Vision.

However, the mere consideration of market trends does not suffice to put forward a well-suited long-term diversification strategy: endogenous factors, in accordance with the Resource-Based View, are indeed crucial. These factors, in fact, more than exogenous ones, determine the relatedness of the cloud computing business with existing businesses, as well as TIM's ability to exploit such relatedness. In a similar fashion to what so far done, these

[11] Customer Perceived Value is a widely used concept in marketing, stemming from the belief that the success of a product or service depends not in its objective value, but in the customer's perception of whether or not it can satisfy his/her needs and wants.

are distinguished in supply-side and demand-side factors and represent both the motivation for TIM's strategy and the possible sources of competitive advantage for the incumbent.

Supply-side factors, i.e. those factors that allow to reach economies of scope in the creation of the supply, relate to three core areas: assets, organization and competences (see Section 2.3.1.1). The first concerns all the tangible and intangible resources that TIM owns which are exploited in both its traditional businesses and in cloud computing: the network infrastructure, in its backbone and distribution components; the patent portfolio (3.285 as of 31st December 2018), for instance on Network Virtualization technologies and Big Data Analytics (TIM, 2019b); the datacenter infrastructure itself, which, as mentioned, was first developed for TIM's internal applications and services.

Organization factors, instead, refer to those elements in the organizational structure and external relationships that are employed in the realization of both lines of service (TLC and cloud). As for internal structures, these realize important scope economies and include: sales and pre-sales functions; R&D departments; control rooms for the monitoring of DCs. As a simple example, a business salesman, after a brief training, can easily propose IT solutions to its customers along with connectivity or mobile SIMs. Of course, this does not mean that such structures are sufficient in size for the provision of both services, but their expansion still allows to enjoy economies of scope (and scale). Furthermore, synergies can be found in the network of partners and suppliers that TIM has developed over the years, starting from the large vendors of networking devices (e.g. Cisco, Huawei), but also including a range of software producers (e.g. of SaaS services in TIM Digital Store) and numerous sales agency that bring TIM's products and services to smaller business customers.

Last but not least, supply-side factors include core competences and capabilities that TIM acquired through its traditional businesses and can be further exploited in the new cloud computing business. Particularly, as explained in Section 4.1.1, competences in networking are certainly vital to build and operate datacenters, both within the single DC and to construct a network of DCs. Interestingly, cloud computing concepts such as virtualization are becoming the new TLC paradigm, i.e. Network Function Virtualization (NFV) and Software-Defined Networking (SDN). Therefore, the acquisition of competences typical of the cloud business has actually proven to be fundamental for competing in telecommunications as well.

Still, the importance of supply-side assets with regards to competitive positioning depends on a comparison with competitors. These, in accordance with the outline presented in Chapter 3, are divided in Italian providers and large multinational CSPs. With respect to all Italian competitors, TIM's infrastructure of datacenter is above all richer. Most providers have a 3 or 4 DCs connected with one another (Aruba has 3 with one in construction, Tiscali has 4), but none of them can equal TIM's network of 8 proprietary, self-managed DCs distributed all over the national territory. Some providers actually rent the infrastructure or datacenter space from others, such as Vodafone from Aruba, retaining less controll over the whole service than TIM does.

Also, TIM's rich and interconnected architecture allows to offer additional services such as distributed architectures, disaster recovery and business continuity solutions. With respect to international CSPs, however, these characteristics are not that exclusive and unique, but actually worldwide leaders like Amazon and Microsoft offer a variety of advanced services and an unparalleled agility and flexibility, as well as architectures distributed over larger geographical regions. This, indeed, is advantage for multinational Italian companies, active in all Europe or in the whole world. Still, some Italian firms may need to retain their data on the national territory for compliance reasons, such as banks or healthcare companies. In other words, TIM's long-standing presence in the Italian market grants it a possible advantage for factors that relate to demand.

The other side of the coin, in fact, are demand-side factors, which generate consumer synergies by combining different kinds of services under the offering of a single provider (see Section 2.3.1.2). On this regard, TIM has three kinds of fundamental strategic assets. First, its customer-base of almost 50 million customers, is unequalled in the overall Italian ICT industry and encompasses not only a large share of residential users but also firms of all size, from SMEs to large companies. Second, its customer-knowledge was developed over decades and reaches every corner of the country, even the most remote areas. Third, its strong customer-relationship asset results in the trust that many clients place in TIM as incumbent provider.

In short, TIM can employ its current demand-side assets in the cloud computing market to achieve consumer synergies, and specifically: its large userbase; the intimate knowledge of the Italian market; the specificity of its offer for the Italian market (e.g. customer support channels entirely in Italian); the reputation as a trusted provider. Furthermore, for an Italian

firm it could be a prospective strategic advantage to build a relationship with a carrier on the frontline for the development of technological innovations like 5G, as it could open up the opportunity to exploit such new technologies. As a matter of fact, edge computing architectures will most likely need 5G connectivity to realize low-latency, high-bandwidth and high-density applications, ranging from autonomous cars to Industry 4.0 (Cisco, 2019).

In any case, leveraging these kinds of assets, TIM can deliver its customers one-stop-convenience (which is the concept, for instance, for the IT marketplace TIM Digital Store) and superior customer value (Manral & Harrigan, 2016). This, in particular, refers to the ability of demand-side diversification to actually increase demand: being a diversified provider, TIM can inform and educate its clients about cloud computing and encourage them to consider it. In fact, as it was seen, the delay in cloud adoption in Italy is partly based on a general skepticism towards it, for groundless concerns about data security and a dose of resistance to change.

On this regard, it is worthwhile to focus on the SMEs market. As it was mentioned and is well-known, SMEs represent the overwhelming majority of Italian firms, thus representing a vast market opportunity. In fact, as explained in Section 3.2.3, although at the moment only 37% of firms are choosing or considering the cloud, demand is growing for SMEs as for larger firms, as they experiment and gain confidence at least with basic cloud services. TIM, detaining more than 60% of such market (see Chapter 2) in telecommunications, is the best-suited actor to capitalize on this opportunity precisely because of its demand-side assets: the long-standing trust relationship with its many SME customers can play an important role in winning their resistance to adopt the cloud. In this sense, TIM's interest may coincide with a sort of social mandate to bring the digital transformation to the Italian fabric of firms.

Cloud computing can indeed bring significant advantages to SMEs, from better management of security and compliance, higher efficiency, lower time-to-market and an easier access to innovative state-of-the-art technologies. As a diversified provider, TIM may have a strategic advantage over more specialized operators, as SMEs may have the most benefits from adopting all-inclusive solutions, namely cost savings and a single interlocutor for all main ICT services, so that they can focus on their core business instead. It is indeed more likely that an Italian SMEs would start to interface with TIM rather than Amazon for cloud services, as it is less complex and more present on the territory: most small firms would

prefer a human consultant to talk to rather than the most innovative service, since cloud competences are lacking in the market.

The Multi Cloud offer responds to such market need for consultancy, as well as the necessity to have more than one provider and avoid lock-in effects. This strategic choice of offering a Multi Cloud service is a likely source of competitive advantage, as not many providers can offer a platform such as the CMP described in Section 4.1.2, with all its governance tools and an integrated management and maintenance of devices. Still, consultancy is a crucial factor for two main reasons. On the one hand, the recognized lack of competences: 57% of firms currently delegates the management of complex Hybrid and Multi Cloud systems to suppliers). On the other hand, world like AWS and Azure are hard to navigate and adopt pay-per-use pricing, so that a mistake in design causes a surge in costs. Through assistance in new projects and the tools of CMP, TIM can deliver cost-optimization, a pivotal aspect in the cloud market: the first reason that hinders cloud adoption is the difficulty in estimating costs and economic returns of investment. Also, many customers (and especially SMEs) may not need such complexity and advanced services for the time being, or may have different needs that are better tackled by different services.

4.2.2 Possible shortcomings

If TIM's strengths as large national incumbent may be sources of competitive advantage, other elements may hinder its establishment as market leader. In fact, as it was said, the cloud computing market is more competitive than the telecommunications one, and threats and possible entrants may come from multiple sources. Among Italian CSPs, the main competitor, comparable in size and level of service, is Aruba. It is the only other Italian CSPs with a network of DCs, growing and expanded throughtout Europe – which may be an advantage for Italian firms with a European presence. Furthermore, Aruba is the oldest Italian CSP and is well-known in the industry: in this case, being a diversified rather a specialized provider could be a disadvantage for TIM, which is mostly known as a telecommunications operator rather than CSP.

Still, to most observers it could seem more likely that the strongest competition to TIM will come from the large international market leaders rather than smaller Italian players. From a strictly technological perspective, in fact, TIM's offer in the market are not comparable to those of Amazon or Microsoft for several reasons. Firstly, these complex and advanced worlds offer a far larger number of services and innovative features to best suit diverse

business needs. Secondly, these environments are extremely dynamic, as service portfolios are constantly updated and enriched with new cutting-edge functionalities. Thirdly and perhaps most importantly, services such as AWS, Azure or Google Cloud, truly do fit the cloud computing paradigm as defined by NIST (2011), particularly in terms of on-demand scalability, flexibility and rapid elasticity. In fact, these services offer an agility or automation in the configuration and scaling of resources that TIM is not currently able to offer and lacks the competences to implement.

Therefore, customers with specific or advanced needs would arguably choose to rely on these international providers rather than TIM, provided that they do have the competences to confront with such environments. Also, it is most definetely an advantage for an international Italian firm to interface with a huge global provider. However, many firms still do not have the necessary competences to directly use Amazon's and Microsoft's services. The Multi Cloud service addresses this market opportunity and aims at filling the gap between TIM's value proposition and those of the other CSPs, not by offering something comparable, but instead by integrating in its own portfolio these services, unreacheable for the previously described reasons.

Nonetheless, how the demand market will actually evolve is not predetermined in terms of how much will be outsourced and how much will instead be controlled internally. In fact, if it is almost certain that the industry will evolve towards (multi) cloud architectures, it may be that firms would rather make the strategic investment of developing their own competences for the governance and deployment of different cloud services. In other words, they might choose to fill the gap of needed competence through hiring and training, rather than external consultancy like that of TIM.

There is also, at the same time, the potential risk that TIM's service would lose relevance with respect to the others if specific IT competences are not further developed and internal processes restructured to accommodate a true cloud paradigm. For instance, if in the future serverless computing does become the standard for cloud-native software development and TIM's service does not evolve in that direction, it will essentially be cut out of the market. With Multi Cloud, then, the risk of turning into a Cloud Broker, i.e. a simple reseller of cloud services, is not entirely out of the picture. Also, it may be that Amazon or Microsoft decide to better tackle the Italian market through an expansion of the sales and/or consultancy

structure and adapt to local peculiarities. Still, for the reasons enumerated in the previous Section, TIM's odds, especially with Multi Cloud and 5G, are not poor at all.

4.2.3 Future prospects

Although future developments are, by definition, uncertain, firms' decisions and declarations of intent shed light on the direction the market is following and illustrate the paths that market actors are committed to undertake. On this regard, scenarios in the Italian cloud computing industry are rapidly changing and evolving towards consolidation and intesified competition between market leaders. Particularly, two events are bound to disrupt the current market structure: Amazon's planned opening of a Region in Milan and TIM's announced partnership with Google Cloud.

In November 2018, Amazon AWS announced the plan to open a new Italian Region centered in Milan, adding up to the existing French, German, Irish, UK and Swedish Regions. The new region, launching in 2020, will have three Availability Zones (AZ) and follows Amazon's strategic intent to better serve the Italian market, where AWS' stake is already relevant with important clients like Ferrero, Mediaset, Eataly, Vodafone Italy and the European Space Agency (ESA) (AWS, 2018). In fact, Amazon's presence in the Italian market started in 2012 with the launch of the first PoP (Point of Presence) in Milan, followed by another in Palermo in 2017.

The interest of Bezos' corporation in the peninsula is further proved by the educational and training programmes that Amazon offers for Italian software developers (AWS Educate, AWS Academy and AWS Activate), also in collaboration with local universities, business schools and start-up incubators (AWS, 2018). Indeed, these programmes are indicative of the lack of cloud competences in the labour market, as firms and workers need to be properly trained to be able to navigate AWS' environments. With the further step of opening up a Region in Italy, Amazon clearly aims at intensifying the Italian presence, as it will offer new and existing customers solutions with lower latency and "applications that must comply with strict data sovereignty requirements" (AWS, 2018). This may, indeed, erode TIM's advantage in offering consultancy and a fully Italian-based service.

In turn, TIM's reaction was not only that of developing the Multi Cloud offer to work around its shortcomings, but more recently to establish a partnership with Google. In early November 2019, TIM and Google Cloud signed a memorandum of understanding for the

industrial plan of jointly expanding TIM's infrastructure with new proprietary DCs (up to Tier IV), as well as hiring and training over 800 cloud engineers (Corriere Comunicazioni, 2019). The partnersthip should unfold through the creation of a new company (a joint venture), which may also be listed on the stock exchange in the future. Just like Multi Cloud, with this partnership TIM seeks the help of a major global player with core competences in cloud computing to counteract the two market leaders, AWS and Azure. TIM's intent, in fact, is that of confirming its driving role in the Italian digital trasnformation and establish itself as leader in the cloud computing industry.

If then, Google Cloud can bring to the table its capabilities and experience in running efficient and innovative cloud services, TIM's contribution essentially concerns two strategic assets. First, as it was previously eviscerated, TIM is possibly the Italian ICT firm with the strongest demand-side resources, in terms of customer-base, market knowledge and relationships with Italian firms. Second, TIM (along with Vodafone) is the carrier most committed to the development of the new 5G infrastructure and related applications. In TIM's CEO Luigi Gubitosi's own words: "in the next years cloud and edge computing will represent two of the key markets to most benefit from new products and services enabled by 5G technology" (Corriere Comunicazioni, 2019). In turn, financial markets seem to be sensitive to such topics and positively responded to the planned partnership, with a 3.6% rise in share price following the announcement (Il Sole 24 Ore, 2019b).

As for Edge Computing, in November 2019 TIM launched the first 5G Edge Cloud network with connected drones in Europe. In fact, through its ultrabroadband and ultralow latency, the 5G network allows to collect massive data amounts from an IoT platform, through the use of drones. These Big Data, then, are processed in parts of the network which are closest to devices, allowing for a real time elaboration and response of the (edge) cloud. Furthermore, 5G allows to use a completely safe and dedicated radiomobile network, secured against potential hacks and intereferences. Recently, this architecture started being tested by TIM in collaboration with the City of Turin, for environmental and infrastructural monitoring of rivers, historical buildings and parks (TIM, 2019c).

Turin is not only the city where TIM has its main R&D center, but also the first city where 5G services were experimented, with applications concerning automotive, drones, industry 4.0, digital tourism, Smart Cities and the first self-driving car. In all these scenarios, Edge Computing is the keystone, since none of them is feasible without extrafast data trasmission

(ultralow latency) and nearby processing: self-driving cars would not brake in time to avoid crashes and manufacturing plants would not be able to readily stop if a dangerous event occurs. To complete the picture, TIM and Google Cloud also announced the plan of building a top-of-the-line datacenter near Turin (ANSA, 2019). What is clear, then, is not only that telecommunications and cloud computing are enabling platforms for all the digital applications of the future, but also that these derive from the intersection of different technologies and the related skills: in the end, all such services would not be possible if TIM were not a diversified provider.

Conclusion

The present dissertation seeked to study TIM's diversification strategy in the Cloud Computing market stemming from the premise that TIM's role in the ICT industry is unique and has a highly relevant impact on the Italian economy and society. In fact, as incumbent with a dominant position in the telecommunications industry, TIM undeniably plays a central role in the digital transformation, because of its assets and resources, as well as its wide network of partners, suppliers and customers.

Particularly, the discourse addressed questions that are essentially two-sided. On the one hand, with a look at the past, the analysis tried to reveal the path that led TIM to this choice, the evolution of said strategic approach and the motives that underlie the diversification decision. On the other hand, with an eye to the future, the line of inquiry seeked to assess the main traits and boundaries of TIM's position in both TLC and Cloud Computing, with the ultimate goal of determining its odds and competitive levers in the latter.

In order to answer said questions, the Italian telecommunications industry was first of all scrutinized. In many ways, in fact, TLCs are inherently different from most sectors, insomuch as they are arguably the foundation of our current economy and its future digital development. In addition, and precisely for this reason, they are tightly regulated by a sector-specific national agency, i.e. the Italian competition authority for communications (AGCOM). Thus, the analysis, based on the historical background of technologies and regulation, identified structural features of the industry on the one hand and latest trends on the other.

For the first, the industry is described by a high-fixed-costs and low-marginal-costs framework, with strong network externalities, economies of scale and scope and an inevitable path dependency. For these reasons, it is today configured as a mature and saturated oligarchic market. As for latest trends, the industry is moving towards greater competition on the one hand (e.g. Iliad's entrance) and consolidation on the other (e.g. the Wind Tre merger), while services increasingly become commodities and squeeze the margins of all providers. Furthermore, with the convergence of TLC and IT industries, the competitive scenario in TIM's core business is less and less favourable, with profits thinning and threats coming from multiple sides.

With this knowledge, the analysis shifted the focus on TIM specifically, its strategic approach and its stake in core markets. To do so, besides an outline of the group's structure, reference markets and competitive position, the diversification strategy was identified as recurring and cardinal in the firm's modus operandi. Therefore, the concept of diversification was tackled from an Economics and Strategic Management literature perspective. Particularly relevant for the discussion was the concept of "relatedness" in diversification, as its link with corporate performance was extensively studied, however without unanimous results.

Still, it is widely recognized that, as long as it is capable to do so, a firm can exploit producer and consumer synergies deriving from diversification in order to gain competitive advantage. For these reasons, TIM has traditionally chosen to diversify horizontally (i.e. within TLC), following and shaping the technological evolutions of the industry. However, Cloud Computing represents more of a lateral move by comparison, as it refers to a close yet different industry: despite the convergence of TLC and IT, Cloud Computing still retains its distinct attributes and success factors.

Accordingly, the Cloud Computing industry was investigated in a holistic perspective that focused on the Italian market while at the same time maintaining an eye on the international context. First, the sector was defined by its technological paradigm, architecture, service and deployment models, consequently identifying the latest technological trends in the industry. This technical overview served the purpose of understanding the depths of such a complex and variegated market and the main traits of its economic functioning, namely economies of scale and advantages in terms of flexibility and cost savings for adopting firms.

Hence, the industry was evaluated first from the demand-side and then from the supply-side perspective. On the demand-end, Italy was found to be late in cloud adoption compared to other advanced economies, with the industry approaching maturity just now: most large firms are already committed to the cloud transformation but the majority of SMEs are visibly lagging behind. On the supply-end, CSPs are distinguished between the multinational tech giants (Amazon, Microsoft, Google, IBM and so on) and the much smaller Italian providers. The first present an uncomparable offering of efficient, innovative and constantly updated cloud services, especially the pioneer Amazon Web Services (AWS). The latter, instead, have a more limited presence and infrastructure, but can boost better knowledge and understanding of the Italian market. Of these, TIM is so far the largest, with a strong presence

only countered by the main competitor Aruba. Overall, market structure is quite variegated in the three main segments (IaaS, PaaS and Saas) and leans towards an oligarchy, although less so than TLC. The cloud market as a whole is booming in Italy as in the rest of the world, leaving much room for each provider's growth.

The fourth and last Chapter represents the heart of the dissertation, as it brings together the main themes discussed in previous Chapters to construct the core argumentation. By illustrating TIM's assets, resources, offered services and economic results, TIM's position was identified as solid in terms of market share, revenues and respective growth. Particularly, IT revenues have been constantly rising and driving growth of the whole business segment, tangible sign that the adopted strategy is deep-rooted in rich infrastructural and organizational resources and in a profound understanding of market needs.

However, as equilibria in ICT shift and change more rapidly than in most industries, TIM's position in the market is not dominant nor untouchable. On the one hand, it enjoys several potential sources of competitive advantage, namely economies of scope and scale in the supply side and strong demand-side resources (customer-base, customer-knowledge and customer-relationship). This is particularly visible in the SMEs market, where TIM, thanks to its dominant position in TLC, has the largest penetration potential. On the other hand, TIM's cloud services are not comparable with those of the large multinational CSPs, because of their global presence, vast infrastructure, flexibility, cost-efficiency and constant innovativeness. Interestingly, however, TIM seems to be aware of its shortcomings and seeks to overcome them through its Multi Cloud offer, which leverages the market need for integration and governance competences.

On the whole, TIM appears determined to pursue leadership in the Italian Cloud Computing market, by further investing in partnerships and expansion of the infrastructure (e.g. Google Cloud partnership). Competition is intensifying and final outcomes are hard to predict, but as long as TIM will demonstrate adaptive capability, leverage its resources and compensate what is missing, its chances of success are not slight nor unfounded.

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