A Work Project, presented as part of the requirements for the Award of a Master's degree in Management from the Nova School of Business and Economics.

5G AND IOT DIGITAL ERA: THE TRANSFORMATION OF MOBILE NETWORK OPERATORS INTO END-TO-END SOLUTION PROVIDERS

MICHELE NARDELLA

Work project carried out under the supervision of:

Prof. Leid Zejnilovic

22-05-2020

Acknowledgements

I am extremely grateful to Prof. Leid Zejnilovic who have always supported and motivated me with his guidance. I would also like to extend my sincere thanks to Prof. Moinul Zaber for his patience and valuable advices regarding the thesis structure and market overview. Furthermore, I would like to acknowledge the effort of Roberto Gasperini, Mark Harrop, Giacomo Bonazzi, Kiritharan Gangatharan and Federico Boi to offer me their insightful perspectives regarding the current and future disruption of the telecommunication industry.

Table of content

Abstract

The forthcoming 5G and IoT large-scale implementation reveals new business opportunities in completely new sectors that mobile network operators should seize. This survey paper wants to identify the necessary transformations such operators must undergo to build a sustainable competitive advantage in the future industry. A qualitative research composed of semi-structured interviews acknowledges the telecommunication incumbents' stronger intent of diversification and creates the base for strategic recommendations. A sample of recent actions carried out by mobile network operators to improve their position in the 5G and IoT environments is shown at the end of the work.

Keywords

5G, IoT, MNO, Telecommunication, Strategy, Ecosystem, Servitization.

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

1. Introduction

The frenzied quest for optimal developments and enhancements of the network has led mobile network operators (MNOs) into a process of connectivity commoditization (Groene, Navalekar and Coakley, 2017). The fierce competition among operators, caused by the weakened entry barriers, such as the lower brand loyalty and the higher access to technologies, has brought down prices and stripped away differentiating factors. Furthermore, the servitization movement has radically transformed the relationships between suppliers and customers. Nowadays, building long-lasting and close relationships with clients has become a key to success in the fight for market survival. The so-common firm-centric philosophy has now been replaced with total attention towards the customers, who demand more personalization and major delivery of unique experiences (McShane, 2012). MNOs' strategies are evolving from being mere connectivity providers, towards the offering of integrated services that allow them to increase their bargaining power and market position.

The latest of the challenges for operators is the introduction of the fifth generation of wireless technologies (5G), and the Internet of Things (IoT). The former is the new cellular network standard that radically improves the 4G in several dimensions (Andrews et al., 2014), such as speed and capacity, while the latter is a global IT infrastructure aimed to interconnect most of the things present in our society (ITU, 2012). These new technologies opened substantial new opportunities for telecommunication companies (telcos) in several industries and triggered disruption and deep strategic transformation processes in the telecommunication value chain. Experts predict that the disruption will radically change the existing ecosystems, and a new competitive landscape may emerge because of new business models and partnerships. With these changes ahead, there is a need for a contribution that provides a better understanding of the imminent opportunities and challenges present in the telecommunication market which

MNOs must consider if they intend to build a sustainable competitive advantage. The objective of this work project is to fill this need.

The next section describes the state-of-the-art of 5G and IoT technologies, underlining the already identified challenges for telco operators and the potential strategic changes. It is followed by an empirical qualitative research which aims to summarize insightful and personal perspectives of the forthcoming disruption from experts working in the industry. Recommendations relying on the information collected through interviews are developed and some recent actions undertaken by operators to start their 5G and IoT journeys are shown in the sections that follow.

1.1 The Telecommunication Industry at the edge of the disruption

The digitalization phenomenon is shaping the whole society causing major disruptions within many industries. In accordance with the scientific and business community, the innovation that will radically transform the present that we live in is the ensemble of technologies that are bundled under the abbreviation of 5G and represents the fifth generation of mobile networks. This new kind of network is designed to connect virtually everyone and everything together including machines, objects, and devices (Sayrac et al., 2014). The first studies about 5G started in 2008 when NASA and Machine-to-Machine (M2M) Intelligence, an American company specialized in M2M and IoT platforms, collaborated to develop the first 5G concept (NASA, 2008). Currently, 5G offers connectivity for about 1 million devices per square kilometer, a huge improvement over 4 thousand devices that were supported by 4G standards. Measured against 4G, it also provides up to 20 times faster average data speed, with up to one third of latency. Effectively, 5G removes many of the constraints of the 4G and enables the full digital transformation to be achieved. One of the earliest adopters of 5G is South Korea, which implemented it in 2019, making the new network available to a significant part of its population

(Yamada, 2019). Until now, many interesting use cases of 5G have been created, to demonstrate its potential impact. One of the most important effects of 5G is that it enables the large-scale implementation of the IoT. The massive deployment of the IoT will disrupt several industries, such as transportation, healthcare, smart cities, infotainment, agriculture, energy, and manufacturing, enhancing their productivity and efficiency (see Appendix 1 for further details) (Lema et al., 2017). While there is a great value in explaining the general 5G impact on society, in this work project the focus is on depicting the transformation that the telecommunication sector must undergo to create a sustainable competitive advantage in the 5G and IoT spaces.

The competition and concentration level of the market will intensify with the adoption of 5G, due to a strong weakening of information asymmetries and entry barriers (Sujata et al., 2015). New actors such as over-the-top (OTT) firms and micro operators (Krüssel et al., 2019; Ahokangas et al., 2019) may enter the market and take advantage of the incumbents' knowledge gaps or strategy flaws to attract the less loyal customer segments. To avoid such a scenario, MNOs should invest in developing a new agile ecosystem that is focused on the final consumer and delivery of increasingly many new services. As a result, operators may enter into a position of owner of rich data about consumers and reinforce their competitive advantage.

5G eliminates some of the challenges related to the large-scale introduction of IoT – e.g. network latency, speed, coverage, and capacity (Li, Xu and Zhao, 2018). Nevertheless, investments in its infrastructure upgrade, in the situation when returns on 4G investments are still due for some of the telcos, creates doubts regarding their capability to adopt the technology and capture the newfound value from it. In addition, society's opinions over the topic are highly fragmented. Some experts believe that the large-scale implementation of the new technologies will bring consistent benefits and will enable undiscovered use cases. Others, instead, observe such uncertainty with a pessimistic perspective, not foreseeing high growth opportunities due

to the huge financial efforts required and the absence of a significant number of feasible use cases (Grijpink et al., 2019).

1.2 Research questions

Hence, this survey paper wants to address the following questions.

RQ1: What are the strategic opportunities and challenges for MNOs at the face of technological change towards 5G?

RQ2: Which action course could increase the chance for MNOs to timely advance their competitive advantage with the 5G and IoT opportunity, without prematurely cannibalizing their extant business models?

2. Background

The sections below show an overview of the 5G features, emphasizing the challenges that MNOs must face in order to build a sustainable competitive advantage in the telecommunication industry. Then, the IoT technology will be defined and there will be the introduction of the most important part of the work project: the potential transformations of MNOs' business strategy aimed to capture the value created by the IoT-enabled 5G industry.

2.1 The Fifth-Generation Wireless Technology

2.1.1 5G Features and Components

The expert community forecasts $6.8 billion of generated revenues in 2021 by the 5G market, marking a growth of 61.76% in comparison with the previous year (Gartner, 2019). Its steep development is representative of an innovation that is still at an early stage. According to the

technology life-cycle theory, each technology is characterized by its own S-curve with four different phases: embryonic, growth, maturity, and aging (Taylor and Taylor, 2012). The 5G is classified into the second stage of development because the cumulative adoption rate and expenditure of engineering efforts are increasing, as shown in Appendix 2. From a macro perspective, the technology is still characterized by uncertainty, unclear preferences, and high variation levels, depicting a scenario of ferment in which MNOs struggle to emerge with a dominant design (Taylor and Taylor, 2012). 5G is composed of three major groups of services, each with a specific goal: extreme mobile broadband (xMBB) for data speed, massive machine-type communications (mMTC) for network capacity, and ultra-reliable machine-type communications (uMTC) for latency (Webb, 2018). Each of these layers is characterized by specific technologies such as network slicing (Li et al., 2017), low power wide-area (LPWA) standards (Sinha, Wei and Hwang, 2017), microcells, massive multiple input multiple output (mMIMO) and beamforming phenomena (Webb, 2018). For further detail see Appendix 3.

2.1.2 5G Implementation Challenges

There are generic obstacles that make the full implementation of 5G hard for MNOs (Krüssel et al., 2019). This section identifies 4 specific challenges dimensions: economic, human resources, technical, and political. Under the economic point of view, one of the major barriers is the amount of initial investments required to enter the market. The shorter radio waves need the purchase of new spectra from 6 to 300 GHz among diverse frequencies in order to cover up the various use cases and to improve the quality of service (QoS) (European Commission, 2019; Yu, 2019). In addition, the 4G infrastructure needs to be enriched with new towers, antennas, and optical fibers to enhance the performances of the signal and foster phenomena as mMIMO and beamforming (Krüssel et al., 2019). Investments are also required to consolidate the security of the overall IT infrastructure (European Commission, 2019). With 5G cyberattacks

will be more frequent because some physical devices will be replaced with digital software that rely on common standards, easily avoidable by criminal associations. The large-scale introduction of IoT in the society will arise even more security challenges. The interconnection of billions of appliances will allow hackers to scan, analyze, and collect a plethora of information (Wheeler and Simpson, 2019). An example is the Mirai botnet attack in 2016 in which thousands of devices were exploited to shoot down important servers such as Spotify, Twitter, and the New York Times (Huber, 2019). In order to reduce such risks, MNOs must be careful to strictly comply with the GDPR, the net neutrality policy, and all the 3GPP and 5GPP international standards aimed to create a safer online environment (European Commission, 2019). The complexity of the 5G architecture requires new programming and engineering skills that are scarce and thus highly demanded from different industry players (Grijpink and Lung, 2019). From a technical point of view, the interconnected network of billions of devices will require reactive and automated interference management. A precise administration of the different frequency layers dedicated to 3G, 4G and 5G will be necessary (Hossain and Hasan, 2015). The new generation of wireless technology will fasten the convergence between network cloud and IT services, depicting the known phenomenon of *telco cloud*. The latter will demand alignment between the IT and cloud space through common platforms (MIT Technology Review Insights, 2020). The transformations required, as well as the challenges that MNOs are facing are not few. According to Teece (2007), in such global and competitive landscapes a sustainable competitive advantage can be achieved through the development of "difficult-to-replicate dynamic capabilities". Intangible assets like knowledge and brand are not sufficient to retain a strong position in fast-paced industries. It is also necessary to hold competencies related to quickly detect and react to business opportunities and threats while defending and enhancing the internal resources of the company.

2.2 IoT and Telecommunication Industry

2.2.1 The strong position of MNOs in the IoT Market

We are witnessing the dawn of new technological paradigms, including the well-known IoT, an architecture projected to create a network infrastructure composed of billions of devices interconnected with each other. Data analytics skills and cloud technologies will be highly deployed for both 5G and IoT implementations (MIT Technology Review Insights, 2020). For this reason, experts optimistically forecast that the IoT industry will reach the value of $1.6 trillion by 2025 and 38.6 billion devices globally connected (Statista, 2020). Detailed IoT definitions and explanations of its architecture are provided in Appendix 4 and 5. In such a disruptive market, reliability and speed of the signal, as well as network coverage and capacity are key factors to achieve a competitive position. MNOs are working to improve the just mentioned elements implementing LPWA sets of technologies (see Appendix 3 for details) and developing high QoS (Alareqi et al., 2018). QoS can be quantitatively computed through different dimensions like packet loss or transmission delay. In further details, the measurement is defined as a "set of specific requirements provided by a network to users, which are necessary to meet the required functionality of a service" (Carvalho de Gouveia and Magedanz, 2009). Hence, they have been seen as players with high potential in the IoT industry.

2.2.2 MNOs' emerging Business Models and Ecosystems

The great competitive advantage that MNOs hold in the IoT industry might be threatened by a firm-centric business model. Customer-centricity is the key to differentiate offerings and deliver unique experiences to the market, but it cannot be built without external support. Incumbents need to stipulate strategic partnerships and collaborations with manifold players coming from both similar and different sectors (Azad et al., 2016). There will be the creation of relevant ecosystems enriched by several types of companies, such as hardware vendors, IT

giants, tech-startups, managed service providers, and software firms (Krüssel et al., 2019). The carriers' necessity of new innovative partners is depicted by the TM Forum's (2019) plan called Zero-touch Partner Integration. The project aims to automate the creation of Service Level Agreements and of the overall process of new platform partners' onboarding, enhancing the level of efficiency and agility of telcos. The partnerships' goals can vary from improvements of key companies' divisions, the share of common expenses, service cooperation, or major innovations' rollouts (Krüssel et al., 2019). The latter can be attained by carriers in different ways, one of which is the introduction of universities and research centers into the ecosystem. This strategic move will generate clusters of innovation that foster sustainable growth of the telecom, offering it the opportunity to find and establish a killer application or a dominant design. Nevertheless, a consolidated competitive advantage can be achieved only if all the projects and initiatives are rooted in a planned strategy. The current literature defines five different business models that MNOs can apply considering their resources and goals. Firstly, they can opt to be network providers, namely actors that deliver reliable IoT-enabled networks to different industries in order to support business clients to introduce IoT technologies within their campuses. This model requires a deep knowledge of the industry and of the use case in which the network is applied (Ericsson, 2018). Another option that MNOs can pursue is providing through the already existent infrastructures horizontal cloud and connection services to a wider market. Hence, the operators manage the connections of IoT devices, and the data exchanged over-the-air. The milestones of this connection expert position (Qingjun, 2018) is standardization and inexpensive offerings. These two models can scale into more complex and accurate plans that aim to create customized services and persuasive lock-in mechanisms. One of them has its core in the as-a-service model which with the creation of platforms enables business clients to store, process, and exchange data across the value chain and to execute responsive smart decision-making (Ericsson, 2018). These platforms can be either standardized

or highly customized for a specific use case. This model is known as platform provider (Qingjun, 2018) or service enabler (Ericsson, 2018). The fourth strategy is named solution integrator (Qingjun, 2018) or service creator (Ericsson, 2018) and rely on strong customer relationships and differentiation of proposals. It aims to provide end-to-end bundles of services that include apps, software, platforms, and devices, with an excellent level of customization. In comparison with the previous models, it demands deep know-hows concerning multiple industries (Alareqi et al., 2018; Arthur D. Little, 2020). The last strategic alternative attainable by MNOs is known as sensing (Alareqi et al., 2018). Here telcos' sensors collect environmental data and sell them to enterprises to enable IoT services. Appendix 6 shows the main differences between these five strategies. There are also organic and inorganic solutions to develop growth opportunities, and they are described in Appendix 7. Noteworthy, the enormous investments required to enter the 5G and IoT industry can also be flattened by models like the uberization strategy. Telcos will commit to offering relevant data from IoT sensors and detectors to those legal entities that own the sites in which the devices are installed, potentially creating for them business opportunities in different industries. In exchange, MNOs will minimize the renting expenses, allocating the new reserve to other projects and initiatives (MIT Technology Review Insights, 2020).

3. Methodology

This chapter is aimed to define the methodologies applied to the research process. Initially, it defines the scope of the study, identifying the structure of the analysis. Then, the specific methods with which the data were collected, and the limitations are discussed.

3.1 Scope of the study

The goal of this survey paper is to analyze the transformations that MNOs are carrying out to capture the 5G and IoT opportunities from a business point of view. Firstly, a qualitative research is carried out to collect valuable insights and to define potential recommendations related to the strategic journey of telco firms towards end-to-end solution providers. Secondly, the selection and analysis of some of the recent carriers' 5G and IoT initiatives is used to demonstrate the extent of the potential disruption in different industries and the potential strategic choices that MNOs could follow in the next future.

3.2 Data Collection and Analysis

The work project relies on primary data collected through a qualitative research method, by the means of seven semi-structured interviews. Of these, six interviews were planned with experts from large incumbent telcos, namely BT, Telefónica, Telecom Italia, and Vodafone. All the professionals interviewed work in strategic departments, thus dealing daily with some sorts of 5G and IoT opportunities. An additional interview was planned with an academic expert, to obtain a different perspective. The flexible structure and the open-ended questions allow to focus more on the interviewees' area of expertise, fostering their engagement in the discussions. The choice of deploying interviews and not quantitative surveys is dictated by the willingness to depict the supply side's perceptions and strategic thoughts regarding 5G and IoT. Details of the carried-out interviews can be found in the Appendix 13. The research process starts with the primary data collection and management, followed by their categorization into classes. Thereafter, the information is connected and interpreted, with the consequent generation of explanatory connotations (Barnes and de Hoyos, 2012). According to the current literature (Saldana, 2015), the qualitative answers provided by experts are divided into seven coding categories: forthcoming opportunities, strategic choices and business models, customer

segments and lock-in mechanisms, partnerships and coopetitive relationships, new competitors, major challenges, and the 2025 scenarios. The most important transformations are summarized in Appendix 8 while the challenges are showed in Appendix 9 through a bubble chart based on three variables: Strategic Importance, Complexity and Danger. Their measurement is carried out with the application of a Likert scale (Albaum, 1997) which ranges from 1 – lowest value – to 10 – highest value. Recommendations are defined based on the insights collected through in the interviews and the framework is presented in Appendix 11. In conclusion, a small sample of recent 5G and IoT initiatives executed by the MNOs under consideration is showed and explained in Appendix 12.

3.3 Limitations

This survey paper has constraints caused by its scope and its qualitative approach. It mainly focuses its attention on the 5G and IoT opportunities, neglecting other important types of innovations. The scope of the research is solely the telecommunication industry, providing information of other sectors with the only aim to show particular 5G and IoT use cases. A major funnel process is depicted by the selection of the most important European telco corporations, ignoring the rest of the world's industry players and all the perceptions of the other side of the market, namely end-consumers and smaller realities. Nevertheless, the shrunk target of stakeholders allows the paper to reach deeper insights without the risk of collecting superficial and secondary data. In conclusion, the sample of the population is composed only by seven interviewees, a number which can be improved with further research.

4. Results: 5G and IoT powered Telcos of the future

4.1 Forthcoming Opportunities

Applying the literature of Chidamber and Kon (1994), MNOs' approach is technology-push rather than demand-pull. The cause is rooted in their eagerness to relentlessly adopt advanced technologies, even though their applications are not discovered yet (Strategy Director). One of the most promising innovations which use cases still must be further explored is the network slicing, a principle that is not yet installed on the software version of 5G bridges (Account Manager; IoT Manager; B2B Head). It may easily revolutionize the telecommunication industry, enabling the distribution of broadband connectivity through micro antennae (microcells and mMIMO, see Appendix 3) which consequently create smaller and customizable networks. As a result, with 5G, MNOs will be able to cover all the grey zones without fiber networks, the higher customization can foster stronger consumer satisfaction and loyalty towards the brand. Another important innovation, the ultra-low latency feature characteristic for the 5G and IoT networks is rooted in the edge computing mechanism (for further details see Appendix 3), a new technology that MNOs must consider. The low signal delay enables technologies such as Augmented and Virtual Reality to find pathways towards wide deployment in several use cases (B2B Head). But, the most important asset that 5G will enable is the large-scale implementation of IoT networks (Academic Professor; IoT Manager). IoT systems have already been deployed in 4G and 4.5G antennae through the NB-IoT protocol, but 5G offers them higher capillarity and reliability. The proliferation of IoT systems positions MNOs to generates cashflows in previously underutilized or unreachable markets, e.g. agriculture, automotive, industry 4.0, smart cities, gaming, and finance (Channel Manager; IoT Manager; B2B Head), although requiring a process of “servitization” (Strategy Director). Interviewed experts pointed out that global crisis, such as COVID-19 pandemic, may direct the efforts for IoT solutions into extremely profitable markets like gaming and video-related industries (Academic Professor), or healthcare and wearables sectors. Other markets, like the

inflated smart metering sector, may experience correction and weaker investments due to the presence of other effective technologies. LoRa, LPWAN, and Sigfox are some of them because they offer better battery performance, cheaper radios, and stronger ecosystems of sensors (Account Manager).

4.2 Strategic choices and Business Models

As mentioned in sections 2.1 and 2.2, the 5G and IoT technologies are still under development and operators struggle to make customers understand their applications and advantages. All the experts forecast that the market's growth will have momentum and will be triggered by the relentless race to the consolidation of a dominant design. Telco operators are trying to differentiate, and the sole offering of connectivity may represent a valid model only if customers can easily build their products and run applications on top of it. Nevertheless, the mere supply of connectivity may disenfranchise carriers from customer relationships, decreasing their understanding of the market. From an enterprise perspective, a network-based strategy may allow MNOs to attain only a minim part of the potential value of an IoT offering. The most of it may be achieved with the implementation of integrated solutions and consulting services (Strategy Director). Telcos should not "deliver a network to create value but deliver value to create a network" (Academic Professor). With such a philosophy, incumbents aim to digitally transform their businesses, becoming end-to-end solution providers who offer internal-developed connectivity and solutions, and partners' specific services (Strategy Director). This blended and hybrid model may define highly customized proposals while also providing more horizontal and standardized solutions, like generic enhanced productivity services (Product Manager). The IoT Manager interestingly pointed out that there may be space for a risk-sharing business model. He depicts a scenario in which the price of the 5G and IoT services is directly proportional to the productivity improvements – e.g. annual savings – that the 5G and IoT

services would provoke. This step may help MNOs to get closer to companies that are suspicious about the innovations and are still struggling in finding the right approach to seize the forthcoming opportunities. The development of internal IoT platforms able to provide telcos insights to enhance their productivity may be another important tool to increase their competitive position. With few changes the internal platform may be enabled for the market, as it happened in TIM (Account Manager). The convergent work of platforms and sensors may create new revenues for MNOs due to the possibility of monetizing the data collected in the external environment – e.g. for aims like water leakages or air pollution. In general, when operators firstly define their strategies, they must clearly choose the role and scope that they want to have in the selected industries to not generate bad feelings into customers (Strategy Director). For what concerns the consumer side, MNOs are planning to not only provide triple plays – i.e. proposals with mobile broadband, mobile connectivity and fixed connectivity – but also quadruple plays – which add the entertainment dimension. In order to enhance the share of wallet in each customer, mobile or fixed connectivity bundles are enriched with services developed by OTT players, such as Netflix, Tidal or Spotify, to which operators pay royalties. The new solutions will surely require recent and sophisticated know-how (Channel Manager). It will thus be necessary to increase the trainings for employees and recruit technical and commercial talents (IoT Manager).

4.3 Customer segments and Lock-In Mechanism

The 5G and IoT are going to have a huge influence on both B2C and B2B markets. The latter will register a stronger impact (IoT Manager) because most of the new technologies' applications are focused on it (Product Manager). The B2B segment can be classified depending on the industry type and on the company's size. For the B2C interviews did not show a precise segmentation. Considering the extent of the customer base, the major KPIs deployed by MNOs

are the average revenue per user and per account – i.e. ARPU and ARPA –, measures affected by the price, and customers' satisfaction and lifetime value (Channel Manager). The most important mechanisms deployed by operators to lock clients in are cross-selling activities and bundles creation. The more products clients have activated with a company, the harder it is for them to switch to other providers (Product Manager). 5G and IoT offerings will also be based on this strategy, which is called anti-churn. It demands close interactions between marketing and customer service departments to generate proposals that require high commitment of the client. A concrete example is the automatically renewed subscription that must be stopped manually (Channel Manager). In general, both technical and commercial lock-in mechanisms to retain customers have been identified (IoT Manager). The former depicts the scenario in which applications run only with other specific services in terms of interoperability. This model is not compatible with the current customers' needs for freedom of choice and flexibility. Innovations like eSIM, a device-integrated chip that helps the owner to switch mobile operators instantly over-the-air, concretely depict such necessity. Hence, the commercial lock-in, namely the improved customer experience, seems to be a better option to pursue for MNOs.

4.4 Partnerships and Coopetitive relationships

The distinctive characteristic of the ecosystem of partners in the 5G telecommunication environment is the new market players. Since the end-to-end solutions will rely on specific use cases, there will be the necessity of actors verticalized on new applications that fill the gaps of knowledge and support the creation of customized bundles. The collaboration between Vodafone and Ubitus, a company operating in the cloud streaming industry, has for example allowed the MNO to enter the gaming industry with a platform called GameNow (Ubitus, 2019). Most incumbents are working either in platforming or in partnering. Platforming means that they develop in-house solutions that are integrated with ecosystem partners' services and

sold in customizable bundles. Partnering implies that the final solution is jointly developed by MNOs and partners (Channel Manager). The partnerships may be carried out with both small enterprises – e.g. tech start-ups –, which offer niche specialization and foster an agile approach, and big corporations (Account Manager; B2B Head). While big corporations may substantially enhance the MNOs' reputation, their hierarchy and bureaucracy may create slowdowns in several dimensions (Product Manager). There are already telcos taking bold actions for creating their own ecosystems. For example, TIM is developing the strategic covenant stipulated with Google, targeting to reach a stronger leadership position in the cloud and edge computing spaces (Telecom Italia (1), 2020). Experts also expect a more open ecosystem for collaborations between direct and indirect competitors to, for example, decrease the huge expenses required from the 5G infrastructure (Academic Professor; Account Manager) or to deliver more customized and enriched bundles of solutions (Product Manager). INWIT, the joint venture between Vodafone and TIM, was established to split the costs associated with the deployment of new cellular stations. The ability to select and invest the right opportunities may be also achieved through agreements with universities and R&D agencies which may represent key players in the MNOs' clusters of innovation.

4.5 New Competitors

The "democratization of technologies" (B2B Head) has made the telecommunication entry barriers feeble, registering in the industry a fiercer level of competition. The major investment for new entrants is represented by the purchase of spectrum, an issue that in some countries has stopped to be a bottleneck. In the US, the FED allows telco companies to rent the unused spectra purchased by competitors, eliminating scenarios in which big MNOs purchase spectra only to prevent other players from deploying it. The low-cost network equipment sold by companies like Nokia and Ericsson is triggering the generation of independent network infrastructures in

firms' campuses (Strategy Director). Therefore, many business customers have been transformed into micro-operators, namely small competitors which replicate the core connectivity services of incumbents in a much "smaller and personalized scale" (IoT Manager). Nevertheless, they do not present a consolidated infrastructure that can provide reliable IoT services. Other important actors entering the telecommunication industry are the mobile virtual network operators (MVNOs), like ho.Mobile and Kena (Strategy Director). They hold neither spectrum license nor network infrastructure, focusing on core-as-a-service solutions and registering high margins (B2B Head). MNOs have started an open vRAN movement which enables MVNOs to fully rely on their network architecture (Strategy Director). This strategic move has transformed the virtual carriers into wholesale customers who might help telco incumbents to reach new industry segments. One expert has identified consultancies as one of the most relevant competitors for mobile operators due to their capability not only to give insightful advice but also to concretely generate technological solutions. Through their deep empathy and understanding of the sector, these players can provide highly customized IoT and 5G services. Therefore, telcos should build long-lasting partnerships with tech-consultancies, such as Accenture or Capgemini, avoiding the path of direct competition, since they have proved their inadequateness with consulting solutions (Strategy Director).

4.6 Major Challenges

The obstacles that telco players are going to face are not few and some of them were already mentioned in the literature review. The most important challenge identified by interviewees is the difficulty of MNOs to attract new partners and to sell the 5G and IoT services that are being developed. Such a task can be hard to carry out above all in fragmented markets where most of the business are SMEs. Companies, mainly the smaller ones, are still suspicious and do not comprehend the utility of the innovations. Also, telco employees must be prepared to

thoroughly explain the new offerings, thus requiring effective training, recruitment, and marketing activities (Channel Manager; IoT Manager). Carrying out such strategies has its costs, making telcos collide with the scarcity of financial resources, mainly deployed in infrastructure and network development (Product Manager; B2B Head). Italy will, for instance, be one of the countries most impacted by infrastructure investments. In 1998 the Decreto Ministeriale n. 381 has limited the antennae's signal up to 6 volts per meter (Ministro dell'Ambiente, 1998), requiring now higher expenditures to enhance the density of cells. This action was also aimed to reassure public opinion concerned about the health-related consequences of radio frequencies. The public opinion is a relevant challenge that MNOs should not underestimate. As an example, on the 4th of April 2020 four 5G stations were burned due to COVID conspiracy theories (Strategy Director). Noteworthy, investments in 4G bandwidth have not been stopped by operators, who thus aim to maintain a strong competitive position within the connectivity market (Academic Professor; IoT Manager). The network superiority war, namely the commitment of significant financial resources to hold the strongest network infrastructure, is still present in the industry (Channel Manager). In the forthcoming future, 5G antennae will be integrated into the already existent 4G network (IoT Manager; Account Manager) and the integration of a high variety of technologies will surely represent an important obstacle for MNOs. Such diversification of devices and use cases identifies the struggle of operators to find the killer application (Academic Professor; Account Manager). The process of development might approximately take 2 years for the B2C market, while 6 to 12 months for the B2B segment since it is the major focus of the new technologies (B2B Head). Therefore, experts do not have extreme concerns regarding fast technological shifts because the technology is still not mature yet to be already overcome by other disruptions (Academic Professor). It is as well substantial to underline that the regulatory environment is relentlessly tilted against MNOs to enhance the level of competition. The latter, together with the

commoditization of the network depicted in Appendix 10, will lead the industry into a stronger pressure on cost optimization, potentially transforming MNOs into mere utility providers. The marginalization of telco players from their value chain, together with the less expensive mobile architecture sold by manufacturers, are real challenges present in the market.

4.7 The 2025 Scenarios

The fierce competition and an inexorable process towards commoditization are substantially reducing the profits in the telecommunication industry. If we also consider the current socio-economic crisis, the uncertainty regarding the future developments of the market is extreme. The interviews have jointly identified two potential scenarios for 2025 called "commodity" and "innovation". The former represents a concentrated telecommunication industry, in which companies prefer to sell connectivity as a utility rather than innovate their businesses. Hence, big incumbents who were able to exploit large scale advantages and to incorporate smaller competitors will have a prime position in the industry. There will not be a competition based on customization and uniqueness, but rather on prices and standardization. In such a scenario, tech companies and consultancies will be key players in the 5G and IoT markets, relying on telcos only for connectivity. The second forecast depicts "a sector that will be revolutionized into an embedded fragmented market and will be integrated into diverse industries, rather than being a clearly defined industry with businesses performing very narrow functions" (Strategy Director). This scenario will be the result of a relentless transformation of MNOs into verticalized actors, with differentiated and customizable service portfolios. Tech firms and consultancies will face the strong connectivity and the deep 5G and IoT expertise of telcos, rather choosing to collaborate and stipulate partnerships than directly competing with them. MNOs will be enabled by their widespread networks to massively collect information and sell them to corporates, applying strong processes of data monetization.

4.8 Recommendations for building the Telco of the Future

Considering the insights shown in the previous sections, it is reasonable to build a framework that telcos could follow to achieve the position of the end-to-end solutions' providers. The model displays short and long-term perspectives. Starting with the short-term, agreements with equipment providers and joint ventures with competitors would help MNOs to exploit economies of scale, reducing costs, and enhancing margins. The efficient deployment of technologies like network slicing and edge computing is essential in this first phase where the main sources of monetization would be 5G connectivity services. Once the network dimension has been radically improved, the creation of bundles may better lock-in customers. For what concerns the enterprise space, 5G connectivity may be offered with standardized IoT platforms through either a risk-sharing or data monetization business model. The end-consumers instead demand major entertainment. Mobile and fixed 5G connectivity may thus be bundled within high-quality quadruple plays with OTT players. The standardization characterizing the short-term perspective may increase MNOs' financials and market position. Considering the long-term outlook, to create vertical and specific solutions operators may need a deep understanding of the market. Collaborations with consulting firms may help them to overcome such a challenge. Once MNOs have gained a holistic view of the current market trends, they may think to apply a selective approach to identify and pick the industries of major interest and with higher growth potential. The acquisition of specific know-how through new talents, training, and vertical partners is fundamental. Hence, MNOs would have all the requirements to start developing and sell vertical services for specific use cases. The higher the customization, the stronger the lock-in mechanism. The main focus may be the B2B market since most of the existent 5G and IoT applications are associated with it. The new cashflows may be destined to discovering new market opportunities and use cases, thus requiring to apply again the selective approach of the framework. Appendix 11 displays the process described graphically.

5. Primer of MNOs' use of 5G and IoT

The following section analyzes some of the recent actions that support the MNOs under the scope to gain competitiveness in the new disruptive industry. Insights were collected through interviews and secondary research.

As it is observable through the previous interviews, one of the most relevant strategies to seize the opportunities of the next generation of wireless technology is cooperating with partners. In the recent years most of the telco incumbents have stipulated agreements with both niche and huge players, as well as with competitors. Most of them are partnerships, joint ventures, and acquisitions. Appendix 12 displays five recent initiatives for each analyzed MNO that support them to capture key specific knowledge and skills, to access larger customer segments, and to share costs associated with 5G and IoT network development. Operators are aware that their core businesses are not able to cope with the new specific use cases without external and more qualified help. Nevertheless, their eagerness to become differentiated and unique actors leads them to get closer to research agencies, tech start-ups, and universities. An ecosystem enriched by such clusters of innovation, supported by accelerators and hubs, will help telco players to enhance innovations rollout and to decrease the dependency on partners' skills. As it is observable in Appendix 12, MNOs have been mainly investing into industries like agriculture, AI, AR, cloud, cybersecurity, edge computing, financial, gaming, manufacture, logistics, urban, utilities, and VR.

6. Conclusion

The section below explains the final considerations representative of the empirical research, adding potential future implications and the necessity of further research.

This survey paper pursues the aim to define the strategic implications that the large-scale implementation of 5G and IoT technologies will provoke to MNOs, giving them recommendations on how to operate in the forthcoming future. The empirical research has confirmed that telcos are moving towards the fourth strategy identified in 2.2.2, namely becoming end-to-end solution providers with a higher degree of servitization. Hence, the creation of customized and integrated solutions with vertical partners is required. Partnering and platforming will be the two major working methods applied by MNOs, aimed to internally or externally develop specific services. Whereas on the consumer side the offering of major entertainment will demand long-lasting relationships with OTT players, in the enterprise space alliances with tech giants and start-ups will be milestones to create a sustainable competitive advantage. The interviews helped to also identify the major opportunities and challenges associated with the 5G and IoT implementation. Network slicing and edge computing will represent essential technologies that MNOs should fully deploy. Nevertheless, huge investments in infrastructures are required, as well as thorough attention towards new regulations and new required know-how. The skills concerning the new technologies and use cases should be introduced through training, new talents, and vertical partners. The achievement of the position of end-to-end solution providers is not an easy task and MNOs should firstly focus on a near-time monetization strategy to enhance their financial resources. When they have gathered enough financial resources and market knowledge, they can apply a selective approach to identify core and high growth industries and start developing vertically integrated solutions. The last part of the research includes a sample of recent actions carried out by MNOs with the goal to gain expertise in industries that will be milestones in the forthcoming digital society. There have been also carried out agreements with competitors, establishing relationships of coopetition focused on sharing infrastructural costs. In general, most of the projects are partnerships, agreements of co-development, acquisitions, and joint ventures. The uncertainty

characterizing technology sectors is frequently disconcerting, but it represents the answer to their relentless development and uniqueness.

6.1 Implications and further research

This survey paper shows that the 5G and IoT technologies are going to radically impact the overall society, creating new challenges and opportunities for almost every business player within it. All the affected enterprises should start a process of transformation to sustainably grow in the market and establish their new dominant designs. During such a digital era, mobile operators are going to be one of the core actors due to their connectivity and widespread network. The mainstream direction leads them to become solution integrators and digital experience enablers, but it is still uncertain the real role that they will play in the future industry. The high volatility of the market – which depends on the country, local regulations, and types of incumbents, just to name a few – does not help to clearly define a sharp section of the future telco environment. Therefore, further research is required to reduce this ambiguity. It can be carried out in the shape of quantitative analyses through questionnaires to larger to generalize the findings discovered so far. Even if this work is narrowly focused on one of the 5G and IoT impacted industries, researchers can take inspiration from it developing more complex and sophisticated analysis.

7. References

Ahokangas et al. 2019. *Future Micro Operators Business Models in 5G*. The Business and Management Review. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3410912

Al Falahy and Alani. 2017. *Technologies for 5G Networks: Challenges and Opportunities*. University of Salford. http://dx.doi.org/10.1109/MITP.2017.9

Alareqi et al. 2018. *A Survey of Internet of Things Services Provision by Telecom Operators*. EAI Endorsed Transactions on Internet of Things, pp. 3-9. doi: 10.4108/eai.13-7-2018.155571

Albaum. 1997. *The Likert Scale Revisited*. International Journal of Market Research, Vol 39, n. 2, University of Oregon. https://journals.sagepub.com/doi/pdf/10.1177/147078539703900202

Andrews et al. 2014. *What will 5G be?* IEEE Journal Vol. 32, n. 6, pp. 1065-1066. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=6824752&casa_token=f818BrwJqaIAAAAA:XjO1rpAYFEIzjKi5-ZWYfkqddeWQM3_BH9a6WyJ5vEZhtSBGn8esd-ZMqR4X0Twocqq9IwQab68G&tag=1

Arm. 2019. *Arm and Vodafone Commit to Work Together to Simplify Internet of Things (IoT) Deployment*. https://www.arm.com/company/news/2019/02/arm-and-vodafone-commit-to-work-together

Arthur D. Little. 2020. *Embracing the Future: How can Operators Embrace Telecom Disruption?* Telecommunication Industry Report – 2019 edition. https://www.adlittle.de/sites/default/files/reports/adl_embracing_the_future-compresse.pdf

Barnes and De Hoyos. 2012. *Analysing Interview Data*, Warwick Institute for Employment Research. https://warwick.ac.uk/fac/cross_fac/esrcdtc/coretrainingmodules/quals/analysing_interview_data_1_-_w6.pdf

BT (1). 2019. *BT Brings 5G Future to Belfast Harbour with "Live" Demonstrations of Augmented and Virtual Reality*. BT Newsroom. https://newsroom.bt.com/bt-brings-5g-future-to-belfast-harbour-with-live-demonstrations-of-augmented-and-virtual-reality/

BT (2). 2019. *Gemini Joins the BT Radianz Cloud Community*. BT Global Services News Press. https://www.globalservices.bt.com/en/aboutus/news-press/gemini-joins-the-bt-radianz-cloud-community

BT. 2017. *BT and Hitachi Partner to Develop Industrial and Enterprise IoT Solutions*. BT Global Services News Press. https://www.globalservices.bt.com/en/aboutus/news-press/bt-and-hitachi-partner-for-industrial-iot-solutions

BT. 2018. *BT to Help Manchester Become a "Smart City"*. BT Home News. https://home.bt.com/tech-gadgets/internet/connected-home/bt-to-help-manchester-become-a-smart-city-11364075556527

BT. 2020. *BT Becomes First European Network to Partner with Google on New Stadia Home Broadband Offers*. BT Newsroom. https://newsroom.bt.com/bt-becomes-first-european-network-to-partner-with-google-on-new-stadia-home-broadband-offers/

Campbell et al. 2017. *The 5G Economy: How 5G technology Will Contribute to the Global Economy*. IHS Economics and Technology. https://cdn.ihs.com/www/pdf/IHS-Technology-5G-Economic-Impact-Study.pdf

Carvalho de Gouveia and Magedanz. 2009. *Quality of Service in Telecommunication Networks*. Telecommunication Systems and Technologies Vol. II, EOLSS, pp. 78-79.

Chidamber and Kon. 1994. *A Research Retrospective of Innovation Inception and Success: The Technology-Push Demand-Pull Question*. MIT Sloan School of Management. International Journal of Technology Management Vol. 9, No. 1, 1994).

https://dspace.mit.edu/bitstream/handle/1721.1/48952/researchretrospe00chid.pdf?sequence=1andorigin=publication_detail
Digital Globe. 2018. *Geospatial Data for IoT Solutions: Advancing Wireless Networks to Support IoT Growth*. https://explore.digitalglobe.com/Telecom-IoT.html
Ericsson. 2018. *Exploring IoT Strategies: Insights on IoT Value Chain Positioning from Leading Telecom Service Providers*, pp. 8-11.
ESL Gaming. 2019. *Vodafone and ESL Announce International Esports Partnership*. https://www.eslgaming.com/press/vodafone-and-esl-announce-international-esports-partnership
European Commission. 2019. *Member States publish a report on EU coordinated risk* assessment of 5G networks security.
European Commission. 2020. *Mergers: Commission Clears Acquisition of Joint Control Over INWIT by Telecom Italia and Vodafone, Subject to Conditions*. Press corner. https://ec.europa.eu/commission/presscorner/detail/en/IP_20_414
FRED Economic Data. 2020. *Telecommunication, Cable, and Internet User Services*. https://fred.stlouisfed.org/series/WPU3721?utm_source=series_page&utm_medium=related_content&utm_term=other_formats&utm_campaign=other_format
Gartner. 2019. *Gartner Forecasts Worldwide 5G Network Infrastructure*. https://www.gartner.com/en/newsroom/press-releases/2019-08-22-gartner-forecasts-worldwide-5g-network-infrastructure
Gaver. 1991. *Technology Affordances*. Rank Xerox Cambridge EuroPARC, pp. 79-84. https://doi.org/10.1145/108844.108856
Gopal and Kuppusamy. 2015. *A Comparative Study on 4G and 5G Technology for Wireless Applications*. Journal of Electronics and Communication Engineering, pp. 68-69.
Grijpink et al., 2019. Cutting Through the 5G Hype: Survey shows Telcos' Nuanced Views. McKinsey. https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/cutting-through-the-5g-hype-survey-shows-telcos-nuanced-views
Grijpink and Lung. 2019. *A 5G Manifesto for the CEO*. McKinsey. https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/a-5g-manifesto-for-the-ceo
Groene, Navalekar and Coakley. 2017. *An Industry at Risk: Commoditization in the wireless telecom industry*. PwC. https://www.strategyand.pwc.com/gx/en/insights/2017/an-industry-at-risk/an-industry-at-risk.pdf
GSMA. 2012. *Smart Mobile Cities: Opportunities for Mobile Operators to Deliver Intelligent Cities*. https://www.gsma.com/iot/wp-content/uploads/2012/03/intelligentcitiesreport0411lores.pdf
GSMA. 2017. *An Introduction to Network Slicing*. Future Network Programme. https://www.gsma.com/futurenetworks/wp-content/uploads/2017/11/GSMA-An-Introduction-to-Network-Slicing.pdf
Hossain and Hasan. 2015. *5G cellular: key enabling technologies and research challenges*. IEEE Instrumentation and Measurement Magazine, vol. 18, no. 3, pp. 11-21. https://doi.org/10.1109/MIM.2015.7108393
https://pdfs.semanticscholar.org/5b96/dbd352b753b9adf8206a5cd29c86e4fe023b.pdf#page=17
Huber. 2019. *A Hacker's Paradise? 5G and Cybersecurity*. Financial Times. https://www.ft.com/content/74edc076-ca6f-11e9-af46-b09e8bfe60c0
ITU. 2012. *Overview of the Internet of Things*. Recommendation ITU-T Y.2060, p. 1
Krüssel at al. 2019. *Future Telecom*. Springer International Publishing, pp. 2-3, 25-28, 53-62, 67-74, 89-90

Krzossa. 2019. *Ehang Flugtaxis Fliegen Künftig im 5G-Netz von Vodafone*. Vodafone News. https://www.vodafone.de/newsroom/digitales-leben/urban-air-mobility-vodafone-vernetzt-flugtaxis-von-ehang/

Lema et al. 2017. *Business Case and Technology Analysis for 5G Low Latency Applications*. IEEE. doi: 10.1109/ACCESS.2017.2685687

Li et al. 2017. *Network Slicing for 5G: Challenges and Opportunities*, IEEE Internet Computing, vol. 21, no. 5, pp. 20-27. doi: 10.1109/MIC.2017.3481355

Li, Xu and Zhao. 2018. *5G Internet of Things: A Survey*. Journal of Industrial Information Integration, pp. 2, 17-18. https://uwe-repository.worktribe.com/preview/871355/IoT5m.pdf

McShane. 2012. *Customer Centricity in the Telecommunication Industry*. Pitney Bowes *Software.* https://www.teleinfotoday.com/white_papers/Centricity-telecommunications-Industry.pdf

Microsoft. 2020. *Microsoft to Open New Datacentre Region in Spain and Expand Strategic Partnership with Telefónica to Boost Spain's Competitiveness*. Microsoft News Centre. https://news.microsoft.com/2020/02/25/microsoft-to-open-new-datacenter-region-in-spain-and-expand-strategic-partnership-with-telefonica-to-boost-spains-competitiveness/

Minerva, Biru and Rotondi. 2015. *Towards a Definition of the Internet of Things (IoT)*. IEEE Internet Initiative, *p. 10.*

Ministro dell'Ambiente. 1998. *Decreto Ministeriale n. 381 del 10/09/1998: Regolamento Recante Norme per la Determinazione dei Tetti di Radiofrequenza Compatibili con la Salute Umana*. Gazzetta Ufficiale n. 257, https://www.arpae.it/cms3/documenti/cem/normativa/decreto381_1998.pdf

MIT Technology Review Insights. 2020. *The 5G Operator: Platforms, Partnerships, and IT Strategies for Monetizing 5G*. https://www.technologyreview.com/s/615388/the-5g-operator-platforms-partnerships-and-it-strategies-for-monetizing-5g/

NASA. 2008. *NASA Ames Partners with M2MI for Small Satellite Development*. https://www.nasa.gov/home/hqnews/2008/apr/HQ_08107_Ames_nanosat.html

Newman. 2019. *Vodafone and IBM Sign a $550 Million Deal Forming Joint Venture*. Business Insider. https://www.businessinsider.com/vodafone-ibm-joint-venture-2019-1?IR=T

Prasad. 2016. *5G Outlook Innovations and Applications*. River Publishers. https://www.riverpublishers.com/pdf/ebook/RP_E9788793379787.pdf

Qingjun. 2018. *Six IoT Models: Which Should Telecoms Choose?* Huawei, Issue 84. https://www-file.huawei.com/-/media/corporate/pdf/publications/communicate/84/09-en.pdf

Rao and Prasad (1). 2018. *Impact of 5G Technologies on Smart City Implementation*. Springer. https://doi.org/10.1007/s11277-018-5618-4

Rao and Prasad (2). 2018. *Impact of 5G Technologies on Industry 4.0*. Springer. https://doi.org/10.1007/s11277-018-5615-7

Saldana. 2015. *The Coding Manual for Qualitative Researchers*. Arizona State University. https://uk.sagepub.com/en-gb/eur/the-coding-manual-for-qualitative-researchers/book243616

Sayrac et al. 2014. *On the Need for a New Air Interface for 5G*. E-LETTER Vol. 9, No. 5, p. 18, IEEE Communication Society.

Sinha, Wei and Hwang. 2017. *A Survey on LPWA Technology: LoRa and NB-IoT*. Dongguk University-Seoul, Republic of Korea. https://doi.org/10.1016/j.icte.2017.03.004

Subex. 2019. *Telefónica to Partner with Subex on New Cybersecurity Venture*. Subex Press Releases. https://www.subex.com/press_release/telef%C3%B3nica-to-partner-with-subex-on-new-cybersecurity-venture/

Taylor and Taylor. 2012. *The Technology Life Cycle: Conceptualization and Managerial Implications*. University of Bradford School of Management, pp. 541-553. http://dx.doi.org/10.1016/j.ijpe.2012.07.006

Teece. 2007. E*xplicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance*. University of California, pp. 1319-1350. https://doi.org/10.1002/smj.640

Telecom Italia (1). 2020. *TIM and Google Cloud Launch Strategic Partnership*. TIM Press Releases. https://www.telecomitalia.com/tit/en/archivio/media/comunicati-stampa/telecom-italia/corporate/istituzionale/2020/CS-TIM-Google-04-03-2020.html

Telecom Italia (2). 2020. *TIM and Santander Consumer Bank Launch Joint Venture to offer Consumer Finance to TIM Customers*. TIM Press Releases. https://www.telecomitalia.com/tit/en/archivio/media/comunicati-stampa/telecom-italia/corporate/istituzionale/2020/CS-TIM-Santander.html

Telecom Italia. 2018. *TIM and Huawei to Set Up a Business Innovation Center in Italy Focused on Internet of Things Solutions*. TIM Press Releases. https://www.telecomitalia.com/tit/en/archivio/media/comunicati-stampa/telecom-italia/mercato/business/2018/TIM-Huawei-MoU-27-02-18.html

Telecom Italia. 2019. *TIM and eFootball.Pro Bring Esports to the Next Level with 5G*. TIM Press Releases. https://www.telecomitalia.com/tit/en/archivio/media/note-stampa/market/2019/TIM-and-eFootball.html

Telefónica (1). 2019. *Telefónica and Tunstall Healthcare Will Develop Projects for the Remote Management of Patients in Spain*. Telefónica News. https://www.telefonica.com/en/web/press-office/-/telefonica-and-tunstall-healthcare-will-develop-projects-for-the-remote-management-of-patients-in-spain

Telefónica (2). 2019. *Telefónica and Vodafone to Strengthen their Network Partnership in the UK with 5G Sharing*. Telefónica News. https://www.telefonica.com/en/web/press-office/-/telefonica-and-vodafone-to-strengthen-their-network-partnership-in-the-uk-with-5g-sharing

Telefónica. 2018. *Telefónica Renews Wayra to Invest in the Joint Venture Business Along with its Tech Start-Ups*. Telefónica News. https://www.telefonica.com/en/web/press-office/-/telefonica-renews-wayra-to-invest-in-the-joint-venture-business-along-with-its-tech-startups

TM Forum. 2019. *Zero-Touch Partnering could make Platform "Utopia" Real for Telcos*. https://inform.tmforum.org/catalyst/2019/04/zero-touch-partnering-make-platform-utopia-real-telcos/

Ubitus. 2019. *Vodafone Partners with Ubitus to Launch GameNow® 5G Cloud Gaming Service in Italy*. http://www.ubitus.net/en/release/en20191003.html

Wheeler and Simpson. 2019. *Why 5G requires New Approaches to Cybersecurity*. Brookings, Center of Technology and Innovation. brookings.edu/research/why-5g-requires-new-approaches-to-cybersecurity/

Wortmann and Flüchter. 2015. *Internet of Things*. Business Information System Enginereeing, pp. 221–223. https://doi.org/10.1007/s12599-015-0383-3

Xia et al. 2012. Internet of Things. International Journal of Communication System, pp. 1101-1102. https://doi.org/10.1002/dac.2417

Yamada. 2019. *South Korea to seize on world's first full 5G network*. Nikkei Asian Review. https://asia.nikkei.com/Spotlight/5G-networks/South-Korea-to-seize-on-world-s-first-full-5G-network

Yu. 2019. *Could 5G Stream Higher Share Prices?* Morgan Stanley Research. https://www.morganstanley.com/ideas/5G-telecoms-share-price-drivers

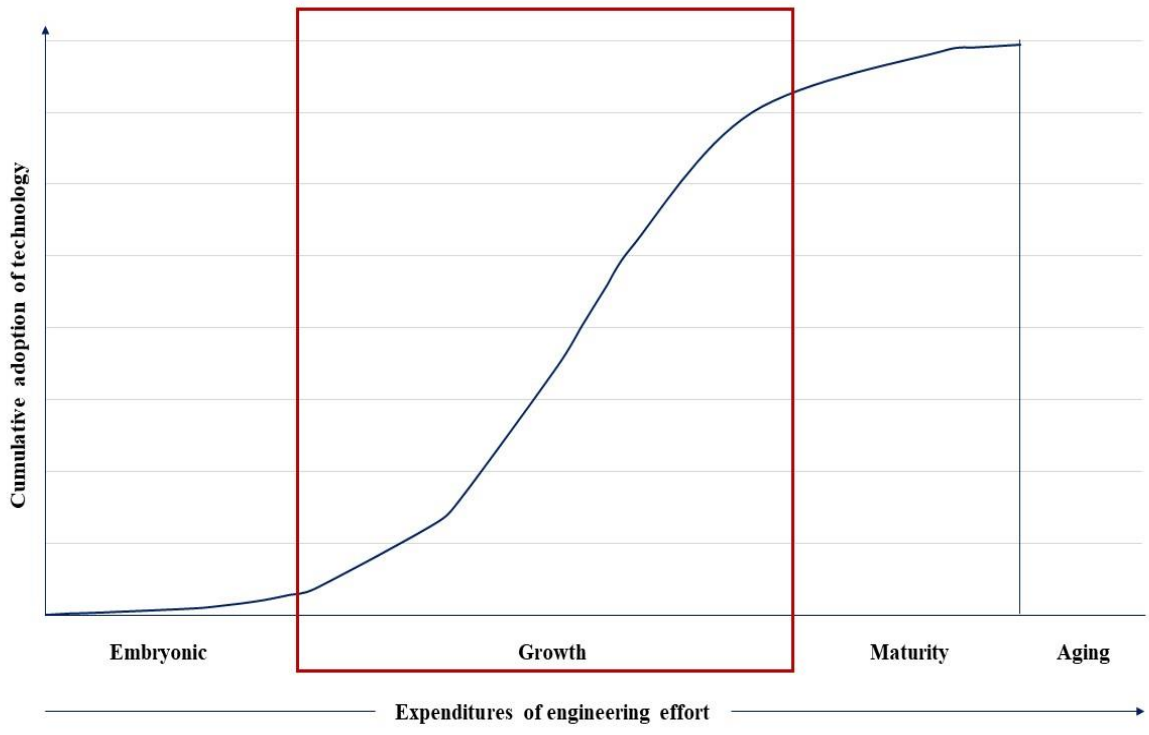
8. Appendix

Appendix 1: 5G use cases and MNOs opportunities (own representation)

Industry	Impact	Opportunities for MNOs
Healthcare	The healthcare industry will be highly impacted by the new technology due to the capabilities to remotely treat patients and undergo robotic surgery (Lema et al., 2017). Therefore, the seamless collection of data through sensors within patients' houses and clothes will enhance the quality of service and the ability to tackle the right issue with the appropriate means (Prasad, 2016).	Network players could either offer connectivity services to patients and hospitals or develop more sophisticated solutions such as platforms of data analytics and monitoring (Lema et al., 2017).
Transportation	Connected vehicles will be the major disruption within the transportation market. On the consumer side, cars will empower new experiences through assisted or autonomous driving, decreased energy consumptions and real time infotainment services (Lema et al., 2017). Moreover, unmanned air vehicles (UAV) would be deployed in logistics, mobility and security services, covering both consumers and enterprises (Campbell et al., 2017). On the corporate space, drones and autonomous vehicles will be deployed to enhance the overall productivity and efficiency of the company. Recently, car OEMs, network operators and chipset suppliers have collaborated to create the 5G Automotive Alliance to foster the development and the adoption of 5G in the industry (Krüssel et al., 2019).	Mobile incumbents could provide services focused on the collection and analysis of data gathered from sensors and wearables in order to give critical information regarding e.g. traffic, routes, vehicle parameters etc. (Lema et al., 2017).
Urban	The transformation of metropoles into huge networks of interconnections will be a revolution of the cities that we imagine today. The so-called smart cities will enable changes into fields like waste management, utility management, disaster management, traffic and public transportations. Public safety will also be tackled by the forthcoming innovations thanks to interconnected cameras, real-time information communicated to law enforcements and identification of individuals among crowds. In conclusion, the urbanization phenomenon might end due to the capability offered by 5G to access into virtual classes and conferences (Rao and Prasad (1), 2018).	Operators can deliver digital solutions for urban needs, such as technology platforms with data storage, analysis, processing and transmission services. They can record city data and sell them to public entities in order to manage traffic, waste, energy and water consumption etc. (GSMA, 2012). Partnerships with local governments are also relevant strategic moves to enhance the position in the market.
Manufacturing	The large-scale implementation of 5G and IoT will revolutionize the manufacturing sector, creating the well-known industry 4.0. The latter will be	The MNOs' proposal could be characterized by enhance productivity platforms focused on

	characterized by high level of automation, real-time optimization, goods' localization, malfunctioning prevention, AR remote maintenance and seamless connection of all the value chain's actors (Lema et al., 2017; Rao and Prasad (2), 2018). Real-time data collection and analysis will be the keys of success in such renovated market.	data monitoring and analytics that support the management of the automated machines (Lema et al., 2017). With insightful advices given by telcos, business customers can save an important amount of financial resources.
Entertainment	In a consumer perspective, the entertainment industry will be the most important sector affected by the 5G and IoT. Wearables will be highly deployed among users and, thanks to the data collected through them, it will be possible the delivery of highly customizable services. Moreover, the immersive and delightful experiences enabled by 5G through AR, VR, and haptic devices will enhance even more the value of the industry.	In the entertainment industry, telecommunication companies could carry out projects in collaboration with e-sports firms focusing on developing cloud-based games (Lema et al., 2017). Moreover, increasing the offering portfolios with services from OTT players will be a substantial move to deliver high customer experiences.

Appendix 2: S-curve phase in which the 5G technology is included (own representation)



Appendix 3: Main technologies composing 5G (own representation)

Group of service	Goal	Technology	Description
xMBB	The xMBB dimension has the purpose to enhance the speed of connection up to 10 gigabytes per second, radically improving the 100 megabytes per second of the 4G technology.	Spectrum	The deployment of higher spectrum, called millimeter-wave bands, in a range from 20 to 90 GHz radically enhance the quality of service (QoS) (Al Falahy and Alani, 2017). Nevertheless, the lower wavelength will require a denser network of antennae.
		Duplex mode	The capability of new cellular base stations to simultaneously transmit and receive signals. The direct consequence is the increase of the process speed (Al Falahy and Alani, 2017).
mMTC	The mMTC aims to enhance by a thousand-fold the capacity of the network, enabling plethora of devices to simultaneously interconnect over the same virtual infrastructure. By also improving the devices' energy consumption, it supports the large-scale implementation of IoT networks.	LPWAN	The technology expands of the signal coverage transmitting data with a low power consumption, thus enabling batteries to run for long time. Thanks to its characteristics, LPWAN will play a vital role for the IoT large-scale introduction, since the latter requires a continuous exchange of information in a relatively wide area. In general, the standard is differentiated in licensed, such as LTE-M and NB-IoT, and unlicensed, and can be applied in different non-mobile industries, such as manufacturing, smart cities, transportation, healthcare, utilities and agriculture. Most of the practical use cases require low power and wide area networks – e.g. smart lighting, waste management, packages track, alarm system and energy infrastructure –, creating a perfect fit with the LPWA technology (Alareqi et al., 2018). The 4G does not have an already implemented IoT-enabler network and thus it needs to be backed up by an external and unlicensed technology called LoRa.
		Microcells	The smaller dimension of microcells will be useful for their installation in indoor and outdoor spaces of urban dense areas. They will be implemented on a street level, not overcoming the roof level, creating the well-known constrains of the signal range. Nevertheless, their dense diffusion and small radius will prevent any interference issue and will boost the network capacity and coverage (Webb, 2018)
		mMIMO	The mMIMO is the extension of the already implemented MIMO mechanism. What really differentiate it from its predecessor is the increase of the antennae's number present at cellular base stations. Its aim is to enhance the strength and the throughput of the signal. The mMIMO also introduce a significant phenomenon named beam forming, which helps to focus the radio energy of antennae

			in certain directions, decreasing its scattering (Webb, 2018).
uMTC	uMTC enables connections to reach almost 99.99% of reliability, consequently decreasing their latency. Indeed, the scientific community confirmed that the technology will reduce delay of the signal from 15 to 1 millisecond.	Network slicing	The network slicing is able to create separated radio waves, each with its own structure, resources and topology (Li, 2017). In further details, each single virtual network relies on a common physical infrastructure and is aimed to focus on specific users' segments, enhancing the customization of solutions and decreasing the cost expenditures (GSMA, 2017). The technology represents one of the most relevant assets that 5G will bring with its introduction, enabling telcos to deliver solutions for specific use cases.
		Edge computing	This new technology brings parts of the data centers close to the edge of the radio links, which directly connect to the remote devices. Hence, the data centers are split into several micro data centers which elaborate specific transactions on-site to decrease the time of sending and receiving information. Public cloud providers or MNOs can offer such technology. A potential further development of edge computing is fog computing, in which the single devices become individual network nodes (Krüssel et al., 2019).

Appendix 4: IoT definitions by two important research companies

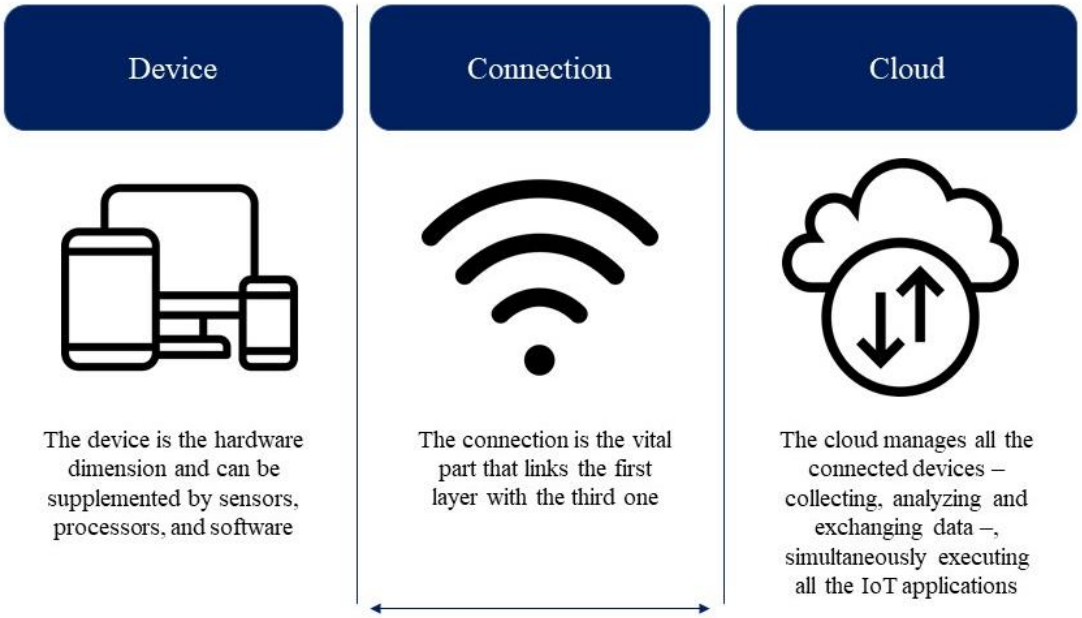
Institute of Electrical and Electronics Engineers (IEEE):

"*IoT is a network of items – each embedded with sensors – which are connected to the Internet*" (Minerva, Biru and Rotondi, 2015).

International Telecommunication Union (ITU):

"*IoT is a global infrastructure for the Information Society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies*" (ITU, 2012).

Appendix 5: The three IoT layers (own representation)

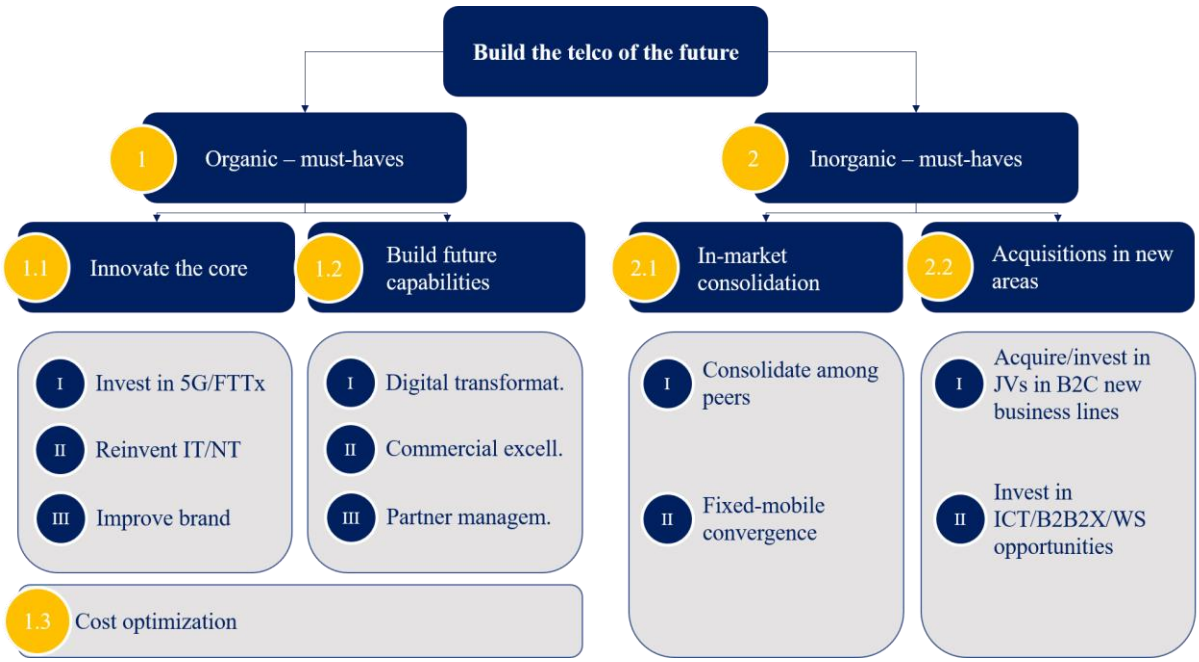


Appendix 6: Comparison of telco IoT strategies (adapted from Alareqi et al. 2018; Ericsson, 2018)

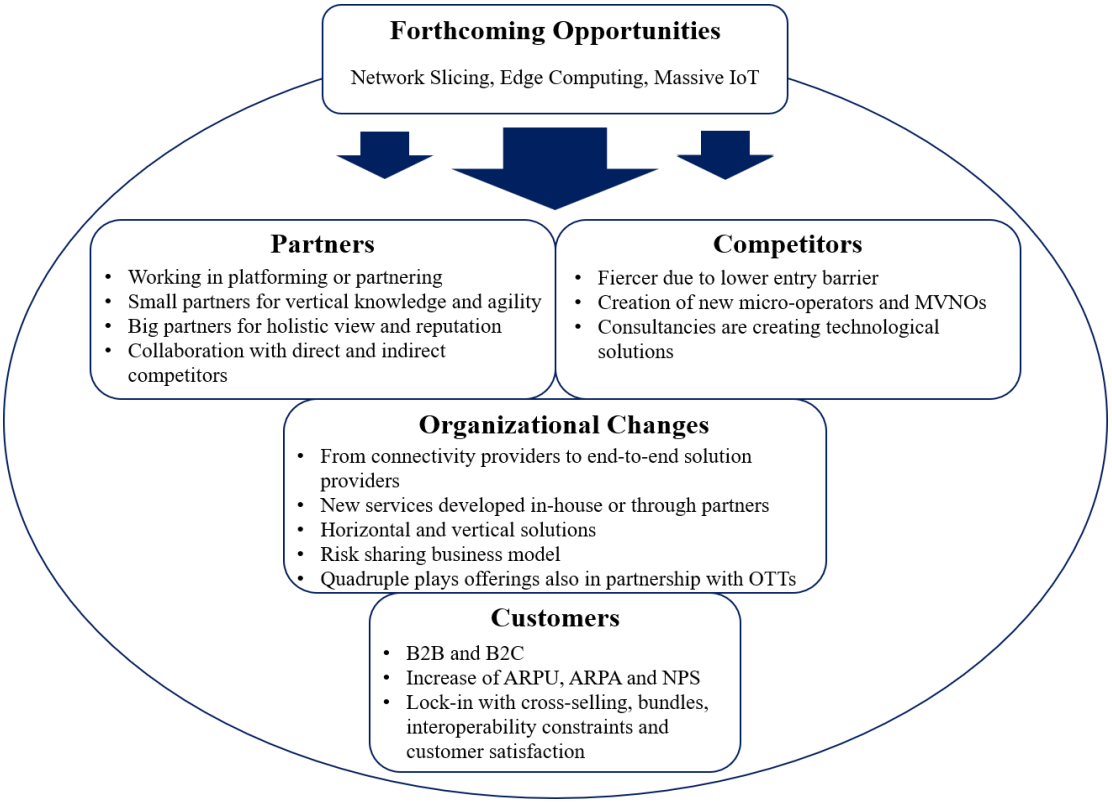
Strategy	**Strengths**	**Weaknesses**
Network	▪ High quality and reliable connection. ▪ Huge customer base. ▪ Inexpensive connectivity package. ▪ Large scale advantage.	▪ Standardized options. ▪ Pressure to keep network prices low. ▪ Weak lock-in mechanisms. ▪ Specific knowledge of the selected verticals and use cases.
Connectivity	▪ Inexpensive connectivity package. ▪ High quality and reliable connection. ▪ Huge customer base. ▪ Large scale advantage.	▪ Standardized options. ▪ Pressure to keep network prices low. ▪ Weak lock-in mechanisms.
Platforms	▪ Analysis and management of data. ▪ Closer relationships with customers. ▪ Enhanced clients' productivity. ▪ Factors of uniqueness.	▪ Ensuring a high QoS. ▪ Expenses of development. ▪ Specific knowledge of software development.

	▪ High quality and reliable connectivity. ▪ Stronger bargaining power. ▪ Stronger lock-in mechanisms.	▪ Specific knowledge of the selected verticals and use cases.
End-to-end solutions	▪ Analysis and management of data. ▪ Closer relationships with customers. ▪ Enhanced clients' productivity. ▪ Factors of uniqueness. ▪ High margins. ▪ High quality and reliable connectivity. ▪ Stronger bargaining power. ▪ Stronger lock-in mechanisms.	▪ Difficult planning process. ▪ Ensuring a high QoS. ▪ High complexity. ▪ Royalties to partners. ▪ Specific knowledge of the selected verticals. ▪ Stipulation of long-lasting partnerships. ▪ Unclear definition of the position in the value chain.
Sensing	▪ Acquisition of relevant data for understanding the market. ▪ Extra-revenues. ▪ Huge customer base. ▪ Low expenses. ▪ Secondary strategy supporting the main plan.	▪ Data storage restrictions. ▪ Power expenses. ▪ Standardized options. ▪ Weak lock-in mechanisms.

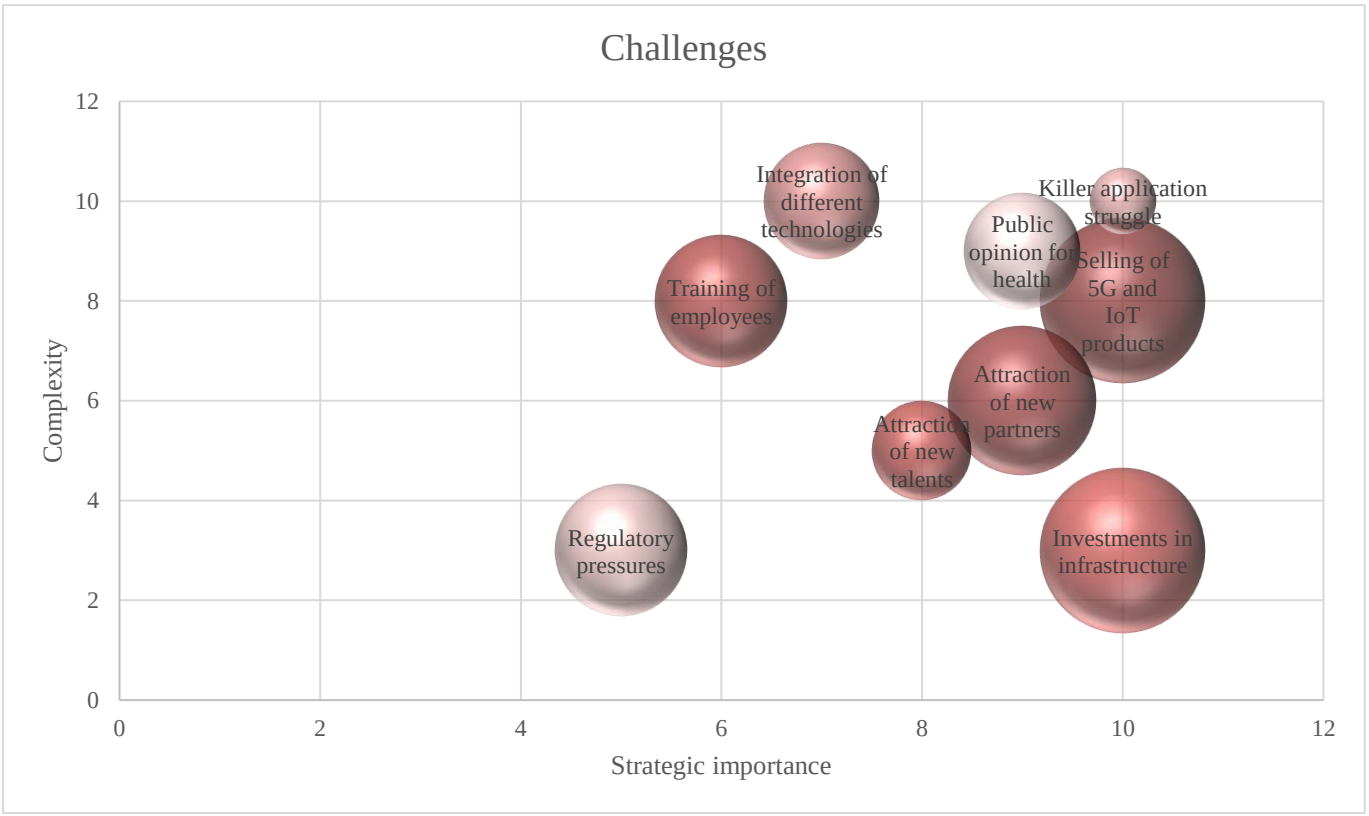
Appendix 7: Organic and inorganic strategies for telcos (Arthur D. Little, 2020)



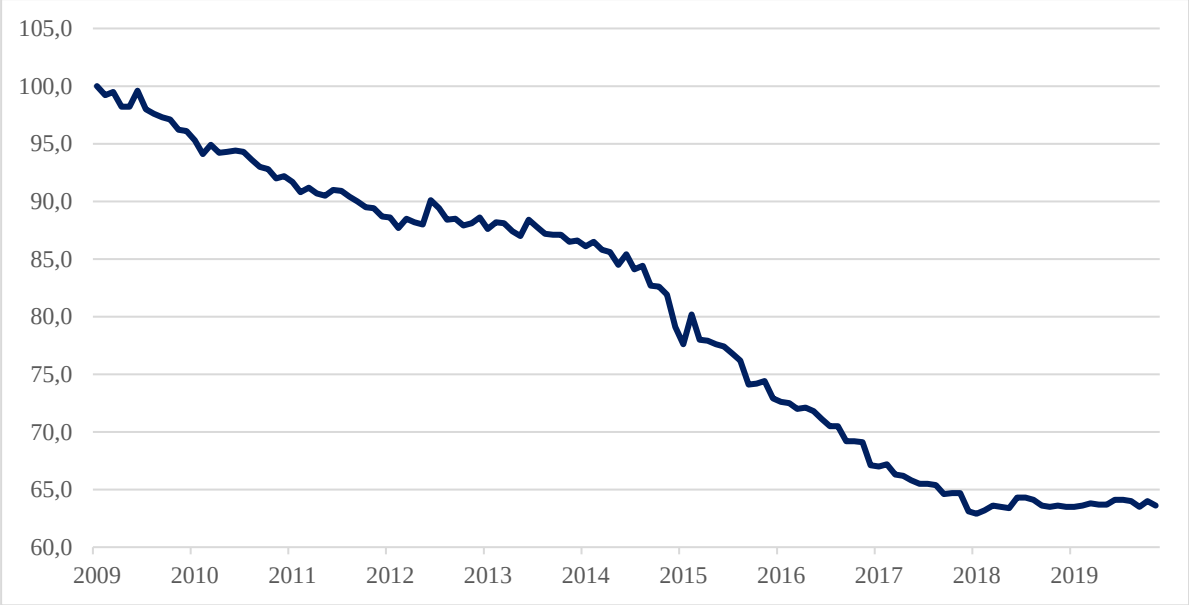
Appendix 8: Major changes coming due to the 5G and IoT disruptions (own representation)



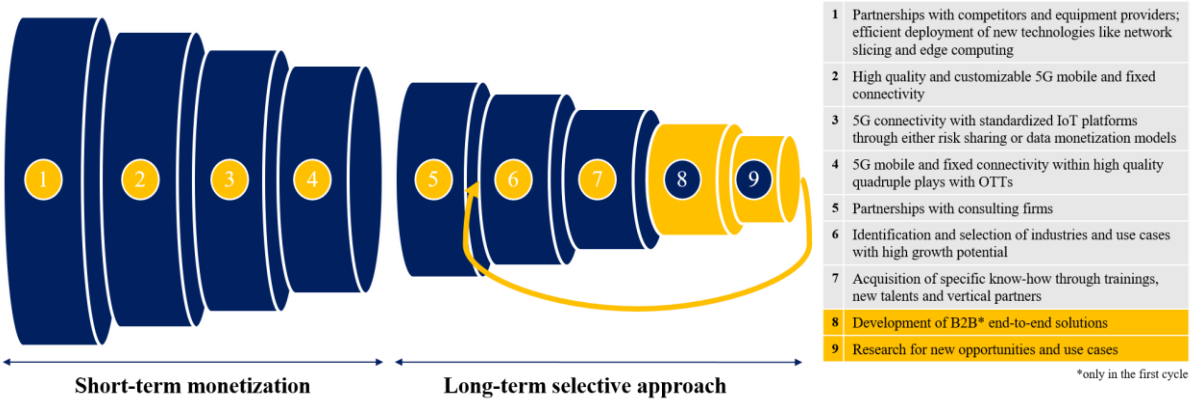
Appendix 9: Bubble chart of the major challenges in the telco industry (own representation)



Appendix 10: Producer price index by commodity for telecommunication, cable, and internet user services: cellular phone and other wireless telecommunication services (FRED Economic Data, 2020)



Appendix 11: Steps to become a telco end-to-end solution provider (own representation)



Appendix 12: Some initiatives of MNOs towards 5G and IoT solutions (own representation)

Company	Initiative	Year	Aim
TIM	Agreement with Google Cloud	2020	Creating stronger competitive position in cloud and edge computing services. Google supports the Italian carrier to create innovative cloud services to enhance its portfolio (Telecom Italia (1), 2020).
	Joint venture with Vodafone	2020	As mentioned in section 4.4, INWIT is a joint venture between TIM and Vodafone aimed to share costs associated to the cellular stations' expansion (European Commission, 2020).
	Joint venture with Santander Consumer Bank	2019	Offering customized financial services in TIM stores to decrease debt and increase credit costs. The Portuguese bank has access to a wider consumers base (Telecom Italia (2), 2020).
	Agreement with eFootball.Pro	2019	Delivering more sophisticated and immersive gaming experiences to TIM customers. This partnership specifically relates to e-soccer games (Telecom Italia, 2019).
	Agreement with Huawei	2019	Creation of business innovation center to jointly share knowledge and technologies in order to research and develop new IoT solutions for specific verticals. The latter include smart metering, smart cities, smart agriculture and smart manufacturing (Telecom Italia, 2018).
Vodafone	Joint venture with IBM	2019	Supporting business customers to cope with the forthcoming disruptions, namely 5G, AI, IoT, edge computing and SDN (Newman, 2019).
	Agreement with Ehang	2019	Entering the urban air mobility market. The partnership defines the

			provision of Vodafone SIM to all the Ehang air taxis that will fly in Europe (Krzossa, 2019).
	Agreement with Arm	2019	Supporting enterprise customers to decrease the expenses related to the implementation of IoT products in their value chain. The key point is to provide connected chips to eliminate the necessity of IoT SIMs (Arm, 2019).
	Agreement with ESL Gaming	2019	Co-developing 5G solutions to disrupt the game industry and promoting female involvement in the esport world, fostering diversity. The creation of a connected community is the key of the initiative (ESL Gaming, 2019).
	Agreement with Digital Globe	2018	Supporting farmers to manage their fields through an IoT platform. The solution is called Sensing4Farming and allows customers, through on-the-ground sensors, to have real-time data and analytical insights about their crops (Digital Globe, 2018).
Telefónica	Wayra	2018	Creating clusters of innovation which foster technological and economic growth of Telefónica, and the start-ups incubated. Wayra have been renovated in 2018 with a major focus on more developed start-ups aligned with the strategic goals of the MNO, e.g. big data, AI, IoT and cybersecurity (Telefónica, 2018).
	Joint venture with Vodafone	2019	Similar to INWIT, CTIL wants to share the costs associated to the network development and deployment. In 2019, the carriers have agreed to focus on the splitting of 5G-based expenses (Telefónica (2), 2019).
	Joint venture with Subex	2019	Supporting business customers to be ready and safe towards cybersecurity threats associated to IoT services.

			The MNO's product portfolio registers an expansion and the network infrastructure, as well as the IoT connectivity platform – Kite Platform – get improved (Subex, 2019).
	Agreement with Microsoft	2020	Boosting the digital transformation of the telecommunication company through the co-development of go-to-market strategies with the tech giant. On the other hand, Telefónica mainly deploys Microsoft's cloud services to digitally transform its business (Microsoft, 2020).
	Agreement with Tunstall Healthcare	2019	Providing services for the remote management of patients, supporting the carrier to enter in the e-health industry through the expertise of Tunstall (Telefónica (1), 2019).
BT	Agreement with Google	2020	Helping BT to gain competitiveness in the gaming industry. The initiative introduces in the product portfolio Stadia, the cloud gaming platform developed by Google (BT, 2020).
	Agreement with Belfast Harbour, Ubimax and VRtuoso	2019	Enhancing the carrier's position within the mixed reality market. The specific aim of the project is to digitally transform the port of Belfast, delivering immersive experiences to customers and optimizing the enterprise operations – e.g. through remote maintenance (BT (1), 2019).
	Agreement with Gemini	2019	Creating a direct channel between BT and the crypto industry, supporting Gemini to access to the larger community of financial actors called BT Radianz Cloud. Therefore, the telco adds in its network a strong expertise in the blockchain industry (BT (2), 2019).
	Agreement with Hitachi	2017	Cooperating to create IoT solutions for global enterprises in order to

			enhance their efficiency and productivity. Initially, the partnership focuses its scope on the logistics and industry 4.0 markets, delivering services of predictive maintenance and asset analytics (BT, 2017).
	Agreement with Cisco, Manchester city, local universities and small businesses	2018	Transforming Manchester into a smart city with a project called City Verve. The initiative supports BT to seize opportunities within the smart city industry and to start gaining specific knowledges and partners in the market (BT, 2018).

Appendix 13: List of specifics, semi-structured questionnaire and transcription of interviews

Shortcut	Expert's name	Expert's role	Company	Interview date	Interview length
Product Manager	Federico Boi	IoT, Cloud and Digital Solutions Product Manager	Vodafone	7.04.20	44 minutes
Account Manager	Roberto Gasperini	Key Account Manager	TIM	10.04.20	1 hour and 13 minutes
Channel Manager	Giacomo Bonazzi	Channel Strategy Manager	Vodafone	12.04.20	1 hour and 47 minutes
IoT Manager	Kiritharan Gangatharan	DT IoT Senior Manager	///	12.04.20	1 hour
Strategy Director	Mark Harrop	Director Strategy and Business Development	BT	15.04.20	56 minutes
Head B2B	///	Head of B2B Product Strategy	Telefónica	25.04.20	46 minutes
Academic Professor	Moinul Zaber	Senior Academic Fellow	United Nations University	06.05.20	32 minutes

Open questions for qualitative interviews to telco managers

Focus	Questions
Background of interviewee	How long have you worked in the telco industry?
	What is your current position in your company?
	How do you assess your personal knowledge about 5G?
Foundations for the shift	Did your company pay-off the investment in 4G? Are there concerns of too fast technological shifts?
5G and IoT opportunities and transformations	Which are new services that 5G enables that could be attainable by your company? What do you see as the highest potential new service by the telcos, or other related companies, that 5G enables?
	How will the business model of your company change in order to exploit the 5G opportunity, specifically in regards with IoT? How are characterized the strategies that your company wants to apply?
	How the 5G and IoT opportunity will affect your revenue streams? What will be the most promising new revenue streams?
	How will the 5G and IoT opportunity change your customer base? How will the value be created and delivered to the customers? What are the planned lock-in mechanisms?
	How will you build an ecosystem aimed to generate a sustainable competitive advantage in the 5G and IoT market and what kind of partnerships will you stipulate?
	In such changing scenario, how do you perceive the position of local carriers? How do you think the relationship between global and local carriers will develop in the forthcoming future? How will your value chain and your position within it be affected?
5G and IoT challenges	How the 5G and the enabled IoT will disrupt the competitive landscape? What are the new major competitors with whom your company must deal with in the forthcoming future?
	Besides the fiercer competition, what are the perceived challenges for MNOs in regards of the 5G and IoT spaces? How are you planning to overcome them?
	How is your company organizing and prioritizing its investments? How are the resources being allocated among the different challenges?
Outlook of the industry	How will be the evolution path of the telco industry throughout the next 3 years?
	Do you think that the incumbent MNOs will still have a strong position within their industry in 3 years? Why?

Open questions for qualitative interviews to academic experts

Focus	Questions
Background of interviewee	How long have you worked in the academic environment teaching telecommunication topics?
	What is your expertise?
Foundations for the shift	Do you think MNOs have already payed-off their 4G investments? Are there concerns of too fast technological shifts in the industry?
5G and IoT opportunities and transformations	Which are new services that 5G enables that could be attainable by telcos? Among these, what is the service with the highest potential?
	How will the business model of an MNO change in order to exploit the 5G opportunity, specifically in regards with IoT? What are the features of the organizational changes and of the strategies that MNOs want to apply to seize the 5G and IoT opportunities?
	How will the MNOs' overall value chain and their position within it be transformed after the implementation of 5G?
	How the 5G and IoT opportunity will affect the revenue streams of telco companies? Will there be new streams of income and, if yes, what are the most promising ones?
	How will the 5G and IoT opportunity change the customer base of MNOs? How will the value be created and delivered to the customers? What are the planned lock-in mechanisms?
	What are the characteristics of the ecosystem aimed to generate a sustainable competitive advantage in the 5G and IoT market? How will MNOs cope with the increasing need of innovations? What will be the universities' relationship with telcos and their position in such new environment?
	In such changing scenario, how do you perceive the position of local carriers? How do you think the relationship between global and local carriers will develop in the forthcoming future?
5G and IoT challenges	How the 5G and the enabled IoT market will disrupt the competitive landscape of the telecommunication industry? What are the new major competitors with whom MNOs must deal with in the forthcoming future?
	Besides the fiercer competition, what are the perceived challenges for MNOs in regards of the 5G and IoT spaces? How are telco firms planning to overcome them?
	How are MNOs organizing and prioritizing their investments? How are the resources being allocated among the different challenges?
Outlook of the industry	How are your perception of the 2025 telecommunication industry?
	Do you think that the incumbent MNOs will still have a strong position within their industry in 2025? Why?

Transcription of the interviews

Product Manager – 44 minutes

M: Buongiorno Federico, sono uno studente dell'International Master in Management presso la Nova SBE, a Lisbona e sto sviluppando la mia tesi sul 5G e IoT. Nello specifico, vorrei capire quali sono le implicazioni strategiche del 5G e del conseguente abilitato IoT sulle aziende di telecomunicazione. Tu stai lavorando in Vodafone, giusto?

F: Buongiorno Michele. Esatto, sono IoT, Cloud and Digital Solutions Product Manager presso Vodafone Business. Mi occupo delle piccole-medie aziende che nel mercato telco le chiamiamo SOHO e SME. Nello specifico, mi occupo di customer base, quindi definisco le opportunità di up-selling, cross-selling per clienti aziendali di piccole e medie dimensioni. Il 70% circa del tessuto del mercato italiano è rappresentato dalle SOHO e SME.

M: Perfetto, grazie mille. Posso chiederti giusto un piacere? Posso registrare l'intervista per facilitarne la trascrizione?

F: Certo, fai pure.

M: Ottimo. Allora cominciamo, quali sono i servizi che a parer tuo verranno abilitati dal 5G?

F: Innanzitutto, il 5G rappresenterà un importante chiave per l'IoT perché la caratteristica principale del 5G è la latenza, quindi la capacità di un dispositivo di far partire l'emissione del segnale, la quale sarà quindi più rapida. Si avrà quindi una comunicazione più reattiva tra i dispositivi. A livello consumer non cambia molto, mentre a livello enterprise l'impatto è ingente, soprattutto quando si parla di IoT. La motivazione è definita dal fatto che l'IoT nasce come monitoraggio di asset aziendali, quindi una serie di comunicazioni tra dispositivi di monitoraggio e un software aziendale che controlla tutto. Un esempio è un'azienda di utility che, avendo bisogno di monitorare determinati parametri dei suoi contatori in presenti sul territorio, installa una SIM IoT all'interno dei dispositivi e riesce ad avere i dati in maniera precisa e reattiva. Proprio per questo, il 5G è un forte abilitatore dell'IoT.

M: Certo, molto interessante. Devo ammettere che per quanto riguarda la parte descrittiva e tecnica, ho letto molti papers sul web. Passiamo alla parte strategica. Quali sono i piani che le telco applicheranno nel prossimo futuro per catturare tale opportunità?

F: A livello di go-to-market, siamo in una fase di introduzione del prodotto iniziale, bisogna ancora capire come questa cosa venga scossa dal contesto attuale, il quale provocherà un boost nella curva di adozione del 5G e IoT, ora siamo ancora nella parte iniziale dove molte aziende non sono ancora consapevoli dell'iniziativa.

M: E relativamente al tuo campo di specializzazione, vedi il 5G e IoT più applicate sul ramo consumer o sul ramo enterprise?

F: Entrambe le tecnologie, soprattutto l'IoT, hanno molto più potenziale nel ramo aziendale. Il fattore chiave, la latenza, è decisivo nelle operazioni aziendali, mentre rappresenta un asset meno importante per i consumatori finali, ad esempio per guardare una serie TV su Netflix.

M: Molto interessante. Ma nello specifico, tornando al ramo strategico, quest'opportunità nel mercato enterprise come verrà catturata da Vodafone e come affronterete i futuri cambiamenti?

F: Ovviamente partiamo come connectivity provider, però il servizio di connettività sta diventando una commodity, infatti il mercato telco è in declino. Vodafone cerca di differenziarsi offrendo servizi simili a quelli presenti sul mercato o aggiuntivi ad un prezzo ridotto. Questo perché tutto si è evoluto molto velocemente ed è stato complesso gestire la trasformazione nel modo e con i tempi corretti. Tuttavia, un modello di business come descritto non è sostenibile nel lungo periodo e, perciò, vorremmo muoverci verso una strategia di end-to-end provider, cioè vorremmo fornire la connettività tramite le nostre infrastrutture, con il supporto però di partner esterni. Su un mercato corporate, dove il potere di acquisto della realtà commerciale è ingente, cerchi di creare un servizio particolarmente customizzato. Sul mercato SOHO e SME, si lavora nello stesso modo ma si applica meno personalizzazione, creando soluzioni digitali a scaffale leggermente più standardizzate, ad esempio la gestione flotta,

M: Perfetto. E per quanto riguarda i clienti, avete dei meccanismi di lock-in?

F: Come meccanismi di lock-in abbiamo il consueto vincolo contrattuale, ma più importanti sono la creazione di bundle e le attività di cross-selling. Più prodotti hanno attivi con Vodafone e più sarà complesso abbandonarci. Per esempio, se, oltre alla vendita di SIM, è stata applicata la vendita del cloud e delle soluzioni di aumento della produttività, è complesso abbandonare l'azienda supplier del servizio.

M: Si, difatti sono entrambi meccanismi che avevo già trovato nella letteratura presente online. In ogni caso, prima hai parlato di partner. Con l'implementazione del 5G e IoT il vostro ecosistema di partner sarà simile o verrà completamente trasformato?

F: Allora, c'è sempre il doppio lato della medaglia. Il grande player ti porta tanta competenza e lavoro ma poca flessibilità, ad esempio IBM e Cisco, colossi dell'IT che dovuta la loro dimensione hanno comunque bisogno di tempo per modificare i loro piani. Dall'altra parte, hai una serie di micro-player che hanno tanta competenza, piccole start-up, ma hanno meno capacità di gestione. Secondo me non c'è una risposta precisa, è corretto avere un giusto mix tra i due attori. Abbiamo sia colossi che micro-partner per questo motivo perché se tu devi sviluppare dei prodotti nuovi in tempo rapido con la micro-attività ce la fai.

M: Questo è un ottimo spunto per quanto riguarda il lato delle partnership. Relativamente ai competitor invece, che tipologia di relazione avrete? Più un rapporto di competizione o collaborazione?

F: Sicuramente è più collaborazione perché noi ci mettiamo insieme per produrre qualcosa di condiviso, qualcosa che forniamo insieme alla connettività. Considera che noi abbiamo una certa capillarità sul territorio, abbiamo molti agenti fisici, call-center e negozi. Vodafone ha tutte le modalità per andare a contattare le persone e le aziende. Questo è un punto focale molto importante che non tutte le compagnie possiedono, soprattutto i colossi aziendali che sono abituati a lavorare su poche e grandi commesse. Cisco non ti contatterà mai proponendoti progetti. Sul segmento corporate spesso si collabora con grandi player del mercato per lo sviluppo di soluzioni integrate. Tuttavia, altre volte capita che tale cooperazione non avviene perché si pongono come competitors, offrendo piattaforme e servizi simili ai nostri. In generale, si lavorerà molto in partnership. Relativamente i micro-operators, invece, essi fanno parte della clientela e non appartengono alla fascia B2C ma B2B2C. Possono essere considerati competitor con forti limiti, ma offriranno sempre un servizio di connettività pura che ormai viene classificato come commodity, senza aver la possibilità di arricchire i loro piani con servizi IoT.

M: Perfetto, e quali rappresentano invece le sfide più importanti per Vodafone o per una qualsiasi altra telco dovute all'implementazione del 5G e IoT?

F: La sfida più importante è sicuramente avere successo nella vendita dei nuovi servizi implementati. Siamo ancora in un momento di adozione del prodotto quindi è necessario comunicare in maniera ottimale e finalizzare la vendita. Difatti, la parte di go-to-market è la parte più sfidante. L'innovatività dei servizi e prodotti introdotti nel nostro portafoglio è sicuramente un punto di forza per l'azienda, nondimeno rappresenta anche una debolezza poiché la forza di vendita è ancora incerta sulla loro precisa spiegazione. Il risultato è un cliente poco convinto a finalizzare il processo di acquisto. Un'altra sfida molto importante sicuramente è rappresentata dai grandi investimenti richiesti dai network del 5G e IoT.

M: Certo, gli investimenti rappresentano una grande barriera sia per gli incumbents, che per i nuovi entranti. Ma un'opinione personale: come vedi il settore delle telecomunicazioni del 2025? Sara simile a quello presente o sarà radicalmente trasformato?

F: Come in ogni settore, quando si arriva al momento di maturità è necessaria una diversificazione con nuovi orizzonti su cui marginare, altrimenti inizierà la temuta fase di declino. In realtà le telco sono già in regresso da anni e le soluzioni digitali che vengono introdotte rappresentano proprio questa necessaria voglia di differenziazione

M: Ti ringrazio davvero molto per tutti questi insight che, oltre ad essere molto utili per la mia tesi, mi interessano molto personalmente. Grazie ancora e ti auguro una buona giornata.

G: Grazie a te Michele, buona giornata.

Account Manager – 1 hour and 13 minutes

M: Buongiorno Roberto, sono uno studente dell'International Master in Management presso la Nova SBE, a Lisbona e sto sviluppando la mia tesi sul 5G e IoT. Nello specifico, vorrei capire quali sono le implicazioni strategiche del 5G e del conseguente abilitato IoT sulle aziende di telecomunicazione. Tu stai lavorando in TIM, giusto?

R: Esatto, sono un Key Account Manager presso TIM.

M: Perfetto, grazie mille. Posso chiederti giusto un piacere? Posso registrare l'intervista per facilitarne la trascrizione?

R: Certo, fai pure.

M: Ottimo. Allora cominciamo. A parer tuo, gli investimenti nel 4G sono terminati?

G: Spero di sì, perché ormai il 4G registra il 99% di copertura nazionale ed alcune sue microcell sono state trasformate in antenne 4.5G con tecnologia NB-IoT implementata. Spero che non investano più in 4G. Noi come TIM, come sicuramente anche altri in Italia, ci siamo mossi con il 5G a suo tempo e oggi facciamo del 5G una forza importante anche dal punto di vista della comunicazione verso il mondo consumer e business focalizzandoci su dei verticali, come ad esempio quelli della sicurezza, dell'automotive e dell'IoT. Quest'ultimo con il 5G acquisisce delle performance un po' particolari. L'IoT a differenza di altri servizi non ha bisogno di una grande reattività, quindi la latenza, non ha bisogno una grande larghezza di banda, quindi la capacità di banda e velocità, ha invece bisogno di una possente capillarità. questa è la parte più importante. Il 5G, a differenza del 4 e del 4.5G, riuscirà a poter raggiungere e collegare un ammontare di dispositivi notevolmente più ampia, quindi la sua forza è proprio questa.

M: Ci sono altri servizi che sono abilitati dal 5G e che possono essere promettenti nel prossimo futuro?

G: A mio parere, la cosa più promettente ed innovativa è quella che ad oggi non è ancora stata installata sulle versioni software dei ponti 5G installati, e mi riferisco al time slicing, cioè alla possibilità di affettare la banda disponibile rendendola completamente dedicata a un particolare cliente o una particolare attività, pur essendo una banda elettromagnetica. Questo abilita a poter distribuire le connettività a larga banda che prima noi pensavamo essere soltanto trasportabili attraverso la fibra, tramite antenne che racchiudono all'interno una serie di piccole altre antenne (mMIMO), si è in grado di rappresentare delle connettività singole e personali ad ogni end-point della rete. Quindi si va a dividere quella che è la rete globale rendendola disponibile e versatile in modo dinamico - ampliando o restringendo la banda - dando così una flessibilità che oggi le reti wired riescono a performare. L'altra cosa importantissima sono i ridottissimi

tempi di risposta, quindi la latenza, che questa rete avrà facendo in modo che i tempi di risposta siano circa un miliardo inferiori rispetto a quelli che sono adesso. Questo abiliterà, ad esempio, tutti quegli ecosistemi legati alla guida autonoma, all'attività nel mondo industriale dove si potranno controllare bracci meccanici tramite 5G invece che con fibra. Ci sarà un mondo nuovo che oggi non è assolutamente concepibile. La forza del 5G è più su questi fronti. I tempi di risposta più corti sono dettati dal fatto che si comincerà a lavorare in maniera diversa: parte dell'elaborazione della rete avviene già vicino alle antenne, nei pressi delle quali ci sarà una componente cloud remotizzata. Il fenomeno appena descritto viene chiamato edge computing. Tale fenomeno può essere semplificato nel seguente modo. Oggi ci sono nei data center gli elaboratori che raggiungono tramite linee le centrali dove ci sono i ponti radio, i quali si collegano ai dispositivi remoti. Ovviamente, c'è una certa latenza dovuta a mezzi fisici o apparati di switching tra i data center e i ponti radio. Tale latenza, per la navigazione web o per uno streaming video e audio non ha molta importanza. Tuttavia, su un intervento di un pedale di un freno di un'automobile è molto importante. Per accorciare tale ritardo, la comunità scientifica ha pensato di spostare componenti di data center direttamente vicini ai ponti radio. Quindi il computing viene spostato il più possibile verso la parte edge, verso dove ci sono le antenne che poi illuminano con il segnale via etere i dispositivi, diminuendo la latenza del trasporto del bit nella rete dal data center all'antenna. Quella parte remota di computing sarà un micro Data Center che elaborerà determinate transazioni e farà in modo che esse verranno elaborate in loco. Questo elemento è abilitante per tutto quel mondo che concerne, ad esempio, la guida autonoma o remota delle vetture che si stravolgerà nei futuri anni. Il tema dell'IoT esiste da tempo ed è stato già abbondantemente approcciato da tante aziende, vedendo il suo efficace funzionamento. Viene fatto operare sul 4.5G tramite un protocollo chiamato NB-IoT che è uno standard ormai standardizzato e abile arruolato. Il 5G adotterà in una versione non molto differente da quella già implementata. Tuttavia, la capacità chiave della nuova generazione di tecnologie wireless è che riuscirà ad essere molto più capillare. In altre parole, se oggi abbiamo 60.000 dispositivi all'interno di un chilometro quadrato di terreno, domani ne potremo avere milioni. Quindi, amplierà la possibilità di gestire simultaneamente una grande quantità oggetti, offrendo l'opportunità di installare a decine e decine di sensori senza procurare alcun tipo di problematica. Per riassumere, i verticali più importanti sono il network slicing, sostanziale per la customizzazione, e l'IoT. È importante notare che il network slicing andrà a competere con la fibra, il cui maggior costo è rappresentato dalle spese di locazione. In tutte le zone in cui la fibra non è stata installata, probabilmente con l'implementazione del 5G non verrà più installata. Difatti, basterà posizionare antenne parzializzate illuminando tramite le bande contrattualizzate migliaia di clienti presenti nelle aree nere o grigie.

M: Perfetto Roberto, prospettiva molto interessante. Prima appunto hai appunto parlato delle alte revenues relative all'IoT. A parer tuo quali sono i nuovi servizi che possono conferire prossimamente con implementazione in larga scala del 5G i più importanti flussi di profitto?

G: TIM si sta muovendo con alcuni fornitori di sensoristica IoT per catturare tale opportunità. I servizi che vanno di più sono quelli relativi al building automation (la sensoristica per i palazzi) e alle utility (che devono monitorare gas, luce, acqua, etc.), entrambe sfere alquanto inflazionate. Il grande concorrente dell'IoT oggi è la tecnologia chiamata LoRa, la quale non funziona né con il 4G, né con il 3G. La LoRa è una tecnologia radio autonoma con una sua pila protocollare che si basa su trasmettitori che non si basano sulla rete 4G. Noi come TIM non possediamo LoRa. Infatti, tale tecnologia, come protocollo di connessione tra dispositivi, viene adottato principalmente da Enel, EM, e tutte quelle utility importanti che devono cercare di

raggiungere punti neri o grigi senza l'ausilio della normale connessione, utilizzando quindi le frequenze radio. Il focus di tale tecnologia è il metering, settore perciò inflazionato da questo punto di vista. In altre parole, questo mercato è soffocato dalla presenza di un elevato numero di competitor che lavorano su tecnologie diverse per raggiungere gli stessi scopi, cioè acquisire un valore di misura in modo remoto e massivo senza cablaggi. Secondo il mio punto di vista, l'IoT dovrà concentrarsi su altri fronti come ad esempio i wearables, la cui adozione crescerà a dismisura. Un altro settore molto interessante è quello della sanità nel quale si stanno investendo molte risorse e che sta offrendo ottimi risultati per le applicazioni IoT. Proprio negli ultimi anni, sono aumentati gli ospedali che attuano sperimentazioni tecnologiche molto all'avanguardia.

M: Certo, non avrei mai pensato che il settore del metering non fosse così attraente. In ogni caso, relativamente alla clientela, a tuo parere il 5G e l'IoT sono più incentrati su mercati consumer o business?

G: Secondo il mio punto di vista, il focus delle nuove tecnologie potrebbe essere incentrato su entrambi i lati consumer ed enterprise. Infatti, se pensiamo all'IoT applicato al settore del building automation o del metering, è ovvio che si fa riferimento al lato business. Se invece si ragiona in termini di wearables, il lato dell'end consumer sarà di conseguenza molto più importante. Un esempio di settore ibrido è quello dell'automotive, nel quale i clienti possono essere sia business che consumers. Il servizio 5G volto alla creazione di automobili si riferirà a clienti nel ramo enterprise, mentre i servizi abilitati o richiesti dal pilota dell'autovettura si riferirà ad un mercato B2C.

M: Perfetto, quindi potrebbe essere un mix. In ogni caso, ho letto molti documenti che ponevano come soluzione un business model incentrato sull'offerta della mera connettività e servizi di cloud o su proposte più complesse come piattaforme e servizi integrati end-to-end. Questa classificazione riflette la situazione che caratterizzerà TIM?

G: Assolutamente sì. Il 5G si differenzia dal 4 perché è in grado di offrire altri modelli di business che si discostano o prendono ispirazione dai precedenti. Le nuove strategie sono infatti rappresentate da piattaforme aggiuntive che sostengono l'applicazione di nuovi servizi e da customizzate end-to-end solutions che sfruttano al massimo il potenziale della nuova tecnologia. Di contro, oggigiorno il 4G viene fondamentalmente utilizzato per la sua efficiente connettività. Tuttavia, nuove applicazioni della precedente generazione di tecnologie wireless ci sono state durante gli scorsi anni. Un esempio è rappresentato da TIM che ha sviluppato una piattaforma IoT abilitata per dispositivi aziendali da cui importanti parametri vengono misurati. Questi ultimi sono stati analizzati dalla business intelligence ed hanno causato un critico risparmio di energia dal 2016 al 2018. Ora, tale piattaforma, insieme agli oggetti sensorizzati utilizzati per l'acquisizione dei dati, è diventata oggetto di offerta per il ramo enterprise. La maggior efficienza apportata dalla nuova piattaforma è stata conseguita grazie alla sua grande precisione di analisi. Con il 5G tali tipologie di innovazione saranno ancor più efficaci.

M: Certo, e ovviamente offrendo bundle di servizi riuscireste anche a bloccare e creare dei meccanismi di lock-in verso la vostra clientela.

G: Si, nel limite del possibile. Ad esempio, ci sono servizi che offriamo in esclusiva che vengono aggiunti alla piattaforma in questione, creando end-to-end solutions.

M: Per chiudere questo ramo del business model, per quanto riguarda le partnership, ci sono nuovi attori che verranno a far parte della vostra value chain proprio in conseguenza all'offerta di servizi 5G e IoT?

G: Le aziende manifatturiere rimangono principalmente uguali, non andiamo a modificare radicalmente la supply chain. Per il 5G è stata fatta una gara da TIM dove hanno vinto le solite due o tre tecnologie che sono Ericsson e Nokia, definendo quindi modifiche minime sul lato vendor. Tuttavia, il 5G si presenta come un business model innovativo che offre soluzioni ad hoc per specifici use cases. Difatti, da anni è attuata un'implementazione di vari use case che corroborano un elenco di fornitori e subfornitori i quali generano un ecosistema che prima in Telecom Italia non esisteva. Ogni mese creiamo nuove partnership con partner nuovi che hanno delle specifiche conoscenze e delle importanti esperienze in nuovi campi (come ad esempio AR, healthcare, etc). Questi ci aiutano a pacchettizzare un use case, trasformandolo in un percorso commerciale. La risposta è affermativa, il 5G ci sta portando a una serie di partnership che vanno nella direzione di nuove figure, in parte piccole che però hanno una forte verticalità su temi che non controlliamo, in parte grandi, come ad esempio quella con Google. Noi siamo il primo operatore italiano che ha attuato una partnership con Google per unire le forze e creare data center congiunti, questo sia nell'ottica di offrire i servizi Google in Italia, sia nell'ottica di tutto quello che è il mondo del edge computing o cloud. L'unico mondo dove non stiamo investendo risorse è quello dell'automotive, dove i principali player si stanno muovendo in solitario. Ad esempio, non verrà mai attuata una pacchettizzazione di un servizio con Fiat tramite il quale offriamo un servizio di gestione. È anche opportuno precisare che il mondo dell'automotive è ancora nel suo stadio primario di sviluppo per quanto riguarda le nuove tecnologie. Sicuramente, ci sono molte aziende nel mercato automotive, Tesla in cima, che si stanno attivando per attuare il passaggio all'elettrico, raggiungendo poi la guida assistita, semi-assistita ed infine quella autonoma.

M: Vedremo se riusciremo appunto a raggiungere la guida autonoma, in questo momento sembra molto futuristica come opzione. In ogni caso, TIM è un'azienda molto più locale di altre, quali ad esempio Vodafone. Voi come lo vedete lo sviluppo della relazione tra telco locali e globali?

G: Nel mondo delle telco grandi partnership sui servizi in comune non sono mai state attuate o non è mai stato strategico farle. È un mercato molto saturo, soprattutto se parliamo del mobile perché, soprattutto dopo la fusione Wind Tre, si sono creati 3 poli (TIM, Wind Tre e Vodafone) che si dividono il mercato. Ti ricordo che in tempi passati c'è stata una apertura verso operatori virtuali, che oggi sono presenti ma rappresentano la ruota di scorta degli operatori tradizionali, vedi TIM con Kena Mobile, Vodafone con ho. o Iliad, la quale ha conquistato una buona customer base tuttavia non focalizzata al ramo business. Diciamo che grandi partnership non ne vedo, anche se per esempio con Vodafone, TIM ha appena siglato un accordo per la creazione di una joint venture chiamata INWIT, avente l'obiettivo di condivisione delle spese relative alle torri cellulari. Abbiamo scelto di collaborare con Vodafone per spendere di meno, perché ogni volta che costruiamo una nuova torre che può agganciare fino a due o tre apparati

di operatori diversi, avrebbe senso condividere tale spesa con gli altri operatori. Tale joint venture non crea però una completa collaborazione tra noi e Vodafone; quest'ultimo rimane comunque un nostro grande competitor. Dal punto di vista nazionale, Vodafone ha una presenza sul territorio molto importante, come anche in altri paesi Europei. TIM invece ha scelto un'altra strategia, mirando ad aumentare la sua espansione nel territorio brasiliano che è definito come un mondo emergente dove la tecnologia si sta ancora sviluppando. Altri competitor non credo che con il 5G ne arrivino perché il problema è che si devono tutti infrastrutturare. Oggi noi pensiamo a Vodafone, pensiamo a TIM, pensiamo a Wind Tre perché hanno tutti forti infrastrutture. Iliad, ad esempio, ha comprato l'80% in roaming. Tutti gli MVNO non hanno infrastrutture e si basano su quelle degli altri. L'unico competitor importante che notiamo è Vodafone, Wind Tre ha una buona base ma non riesce a fare più di tanto.

M: Ma possono esserci anche nuovi player che rappresentino una minaccia per il vostro business? Ad esempio di OTT?

G: Sinceramente non penso, perché se sei in casa hai il tuo Wi-Fi e se esci non possiedi una SIM di WhatsApp – giusto per citarne uno. Oggi come oggi, la chiamata e gli SMS non valgono molto, sono illimitati, le revenue sono principalmente conferite dal traffico dati. Quindi i clienti possono utilizzare quello che più desiderano, ma infine per la rete dati si appoggeranno sempre ad una SIM di TIM o di un altro operatore. Per noi questi attori non sono un elemento di competizione. Sono gli operatori che possono infastidirci, ma per essere un operatore devi anche aver comprato le licenze, altrimenti non sei autorizzato dal Ministero a "parlare" il 5G. Quindi ora, con la gara già conclusa e gli esorbitanti investimenti già attuati, si conoscono già chi saranno i competitor sul territorio italiano relativamente al 5G.

M: Ecco, appunto relativamente gli investimenti, il 5G e l'IoT sono grandi innovazioni però introducono delle sfide molto importanti, tra cui la sfida economica. Oltre a questa, quali possono essere altre sfide e come le state prioritizzando?

G: Una delle sfide più importanti è quella di trovare la killer application del 5G, un processo raggiungibile tramite lo studio continuo degli use case. Noi oggi non siamo tanto orientati alla tecnologia 5G pura perché la conosciamo e abbiamo collaborato nella sua creazione. Necessitiamo invece di implementarla nei vari nodi in modo più capillare e massivo: è il servizio che deve essere realmente inventato. Ad oggi ci sono tanti casi che affrontano la tematica del 5G e risolvono alcuni dei suoi problemi, ma c'è ancora molta strada da fare. Questo potrà esser fatto con ricerca, ma anche con molta fortuna e casualità. In più, un'altra sfida molto importante nel territorio italiano è la legislazione – Decreto Ministeriale n. 381 – che ci impone delle misure di rumore elettromagnetico che sono le più basse del mondo conosciuto. Anni fa passò una legge che proibiva una misura a terra per metro quadro maggiore di 6 mVolt al metro. La nostra legge Italiana è più bassa delle indicazioni Europee (60 mVolt al metro) e molto più bassa rispetto a quella americana (100 mVolt al metro). Questo significa che per rispettare la norma, potendo erogare minor potenza per ogni singola antenna, la copertura di ogni singola antenna si ridimensiona notevolmente, il che vuol dire che per coprire il territorio si necessitano più antenne. Questo comporta un effort economico più elevato. L'equazione dice che a parità di servizi offerti, New York avrà un numero di antenne molto minore rispetto a quello italiano. Il nostro mercato quindi soffre di questa cosa. Più lavori a frequenze basse e più il segnale va

oltre, ma se le frequenze sono alte, quindi sui gigaWatt, paradossalmente dovremmo installare antenne ovunque poiché l'abilità di penetrazione delle superfici della tipologia di onda è molto bassa. Inoltre, le antenne del 5G coesisteranno con quelle del 4G, ma saranno diverse. In una prima fase si andranno ad utilizzare i siti esistenti, aggiungendo la microcella 5G. In una seconda fase invece ci saranno antenne diversificate. I cavi in fibra vicini alla centrale telefonica saranno comuni, ma tutta la parte di radiofrequenza sarà completamente distinta.

M: Ok, ti ringrazio molto per gli insights. Ora, come opinione personale da professionista del settore, come vedi la tua industria in una prospettiva di short- o long-term?

G: Nonostante queste nuove tecnologie che portano in auge il mondo delle telecomunicazioni, il mercato si sta negativamente ridimensionando. Sia in Europa che in America i grandi big player erano rappresentati dalle telecomunicazioni, oggi non è più così. I giganti di successo sono le aziende che lavorano utilizzando le telecomunicazioni, ad esempio Google, Apple, Amazon, e diventeranno sempre più grandi grazie alla loro abilità di diversificarsi. Le telco non sono mai state in grado di differenziare il loro business adeguatamente. Tuttavia, l'unico modo per sopravvivere in un mercato così competitivo è proprio quello della diversificazione e, personalmente, vedo nell'accordo con Google qualcosa di estremamente importante ed innovativo. Sicuramente, gli operatori telefonici non possono sparire perché il mondo si basa su di loro, tuttavia il mercato in generale sta annichilendo. È come se non riuscissimo, per una questione di competition e standardization, a vendere bene il nostro prodotto. Qui in Italia un mese di servizio telefonico costa €6, €19 per il servizio di connettività a casa in fibra. Mi domando se tutto questo sia realistico. Osservando l'America ad esempio, l'offerta media è tra gli $80 e i $90. Sicuramente la diversa cultura ha influenzato molto il settore. La tecnologia comunque va avanti, le porte in fibra diventano a 600 giga, la banda cresce, e con essa anche l'infrastruttura. Le telco stanno ancora investendo sulla connettività perché la domanda è molto alta, tuttavia la propensione del consumatore a pagare un prezzo premium è molto bassa. Quindi, questo processo di commoditizzazione che ha ridotto drasticamente le revenue forza gli operatori a diversificarsi, cercando soluzioni ad alto margine. Un esempio interessante è proprio quello di conquistare segmenti di clientela ad alta marginalità – fascia enterprise – offrendo servizi end-to-end customizzati.

M: Roberto, ti ringrazio davvero molto per la tua onesta ed esperta opinione che, oltre ad essere molto utile per la mia tesi, mi interessano personalmente. Grazie ancora e ti auguro una buona giornata.

G: Grazie a te Michele, buona giornata.

Channel Manager - 1 hour and 47 minutes

M: Buongiorno Giacomo, sono uno studente dell'International Master in Management presso la Nova SBE, a Lisbona e sto sviluppando la mia tesi sul 5G e IoT. Nello specifico, vorrei capire quali sono le implicazioni strategiche del 5G e del conseguente abilitato IoT sulle aziende di telecomunicazione. Tu stai lavorando in Vodafone, giusto?

G: È un topic molto contemporaneo ed interessante. Si, sono Channel Strategy Manager presso Vodafone e ho parecchi anni di esperienze nel settore delle telecomunicazioni. Ti do la mia personale opinione relativamente il tuo topic. L'evoluzione della rete va a braccetto con quella mobile ma anche quella fissa, che ha sia la fibra sul cliente consumer e small-medium. Le aziende più grandi invece parlano un linguaggio che si chiama SDWAN che è l'evoluzione della fibra ottica e permette ai multisede di avere una connessione tra loro molto all'avanguardia. Ti dico questo perché secondo me il vero titolo della trasformazione strategica è passare da essere connectivity provider, cioè porsi sul mercato come operatore di connettività di linea mobile e fissa, ad essere un abilitatore di esperienze digitali sia su linea mobile che fissa. Nel mondo business sono molto legate a soluzioni professionali, quindi legate all'implementazione di un nuovo modello di business all'interno dell'azienda. Il cliente consumer, invece, vede la connettività come enabler di un'esperienza nuova, per cui non si ha soltanto tutto il mondo del core (minuti, SMS o pacchetti per fare chiamate, scrivere o navigare puramente sul web). Oggi la connettività significa un'esperienza a 360°, per cui si parla di entertainment. Infatti, molte telecom, tra cui anche Vodafone hanno integrato attraverso acquisizioni il proprio core asset di rete mobile e fissa con aziende che avevano contenuto digitale e streaming che offrono al cliente esperienze di intrattenimento. Vodafone vende insieme alla sua rete fissa la Vodafone TV, la quale è 3 mesi gratuita senza vincoli ed è la versione più snella di Sky dove si ha un micro-pacchetto di base e poi tante altre offerte segmentate quali sport, serie tv, cinema etc. Di fatto, la connettività non è più raccontata fine a sé stessa, bensì crei un pacchetto completo creando un'offerta end-to-end dove il cliente poi gode della connettività. Perché stiamo facendo un paragone tra fisso e mobile, e consumer e business? Perché fisso e mobile sono integrati ormai, la piattaforma che utilizzi per accedere a un contenuto che sia essa basata su connettività di linea fissa o connettività di linea mobile, per il cliente finale non fa differenza. Il pezzo strategico quindi è arrivare a un contenuto incluso nell'offerta, di entertainment per i privati o di soluzione digitale per le aziende. L'offerta strategica per i clienti finali ha portato Vodafone a creare partnership con app di contenuto musicale (Tidal o Spotify) oppure anche la Vodafone TV con Netflix e Now TV inclusi, TIM ha cominciato ad offrire TIM Vision, una piattaforma propria di contenuto digitale a cui puoi accedere con il pacchetto TIM. Questo perché non si vuole più offrire solo la mera connettività mobile e fissa, chiamata "dual play", o anche solo la "triple play", che è mobile (telefonia e smartphone), fissa e dati (mobile broadband, ad esempio la SIM dati che metti sul tablet o la chiavetta per connettere il PC). Questi sono però modelli precedenti all'introduzione di contenuto all'interno dell'offerta. Quando quest'ultima è arricchita dal contenuto si parla di "quadruple play" che è un'offerta composta da 4 elementi: connettività mobile e fissa, connettività dati (mobile broadband) e contenuto. Un'offerta quadruple play può essere rappresentata da Vodafone Business, tramite la quale Vodafone non si pone più come connectivity provider, bensì come solution integrator. Non è più Vodafone come operatore ma è Vodafone competente di soluzioni digitali per trasformare il tuo business che si avvale della propria connettività, sia mobile che fissa, per farti istruire di una soluzione digitale. Tale

soluzione digitale può essere propria o di terzi, noi oggi lavoriamo in platforming, dove noi non produciamo soluzioni business proprie, prendiamo quelle di altri attori nel nostro ecosistema, le impacchettiamo e le vendiamo. Le soluzioni per le aziende comunque sono soluzioni segmentate per industria, ad esempio per il retail, per il "partita IVA multi sede", per il commercialista, per l'artigiano, per l'agricoltura, per gli hotel (Vodafone ha un servizio specifico per hotel chiamato Vodafone Hotel) e tanti altri esempi di verticali. Ma ovviamente ci sono anche offerte più orizzontali e standardizzate come ad esempio le classiche productivity app, come Microsoft, Google, Movylo (per i pagamenti). Quindi per fare il sunto, Vodafone si pone come un esperto di trasformazione digitale e un esempio importante è proprio Vodafone Business, ma molti altri operatori europei si hanno un posizionamento business con un brand business. Quindi è necessario riuscire a sviluppare un'offerta che sia in grado di mettere tutto insieme, connettività e contenuto. Con la Vodafone TV, l'azienda non avrà molti ricavi ma raggiungerà un altro importante risultato, cioè la fidelizzazione del cliente e una sorta di meccanismo di lock-in, perché con la fibra Vodafone (che comprendere Vodafone TV) probabilmente avrai un'offerta molto più conveniente rispetto all'acquisto di un piano satellitare Sky. Vodafone Spagna ha portato avanti una battaglia sui diritti televisivi che ha permesso alle telco di aumentare i prezzi delle offerte televisive. In Inghilterra, per esempio, i diritti televisivi della Premier League sono stati equamente suddivisi non solo tra i tradizionali operatori quali Sky o Dazon, ma anche tra alcuni telecom. In generale, la catena del valore viene completamente stravolta, dal brand al marketing e le vendite, le funzioni vengono analizzate e trasformate per offrire servizi differenziati e diversi rispetto agli ultimi anni. Bisognerà rivedere tutto da monte a valle, competenze, know-how, costruzione e declinazione dell'offerta, i canali di vendita e l'utilizzo che il cliente fa dei prodotti. Inoltre, a differenza degli attori OTT, l'offerta degli operatori telefonici non è esclusivamente digitale poiché tramite la loro omnicanalità, i servizi possono essere venduti tramite il canale retail (70-80% circa dei volumi di fatturato) canali digitali, remoti e agenti di vendita con pacchetti di clienti. Questo definisce la necessità di rivedere tutto il mondo del training, recruiting e insourcing della catena di vendita articolata. Invece, il fulcro dell'IoT è sfruttare la connettività per offrire dei servizi a delle aziende, anche se il 99% dei ricavi nel retail, ma come in molti altri verticali, è ancora basato sull'offerta del core asset. Bisogna però sviluppare questa linea incrementale di business per aumentare il fatturato e la differenziazione aziendale. Tuttavia, anche il ramo core dovrà subire piccoli cambiamenti, come ad esempio l'aumento dei prezzi, dell'ARPU (Average Revenue per Unit) e dell'ARPA (Average Revenue per Account), nonché del lifetime del cliente. Quest'ultimo viene incrementato tramite servizi che rendano sempre più soddisfatto il cliente, quindi conferendogli più contenuto digitale. Difatti, è molto rilevante lavorare sulla dimensione chiamata NPS (Net Promoter Score) – una misura che delinea la volontà del cliente di promuovere l'azienda tra amici e parenti.

M: In generale questo richiede uno staff preparato per raccontare al cliente in maniera articolata e comprensibile queste nuove e più personalizzate offerte, giusto?

G: Assolutamente, la catena di vendita è orientata a un racconto commerciale diverso rispetto a prima ed è rivista in funzione del posizionamento fino all'ultimo tassello con cui il cliente ha contatto.

M: Interessante, ma quindi utilizzate questo nuovo contenuto e nuove offerte anche come meccanismi di lock-in del consumatore?

G: Esatto, perché se il cliente è soddisfatto dell'offerta che ha anche contenuto non ti abbandonerà mai. La vera strategia è l'anti-churn, cioè una strategia di creazione e di sostegno alla fedeltà del cliente al brand e al servizio, in un mercato che ha subito negli ultimi 10 anni la più grande guerra sui prezzi. Oggi quindi le offerte degli operatori sono differenti in termini di contenuto e possono essere a propensione ricaricabile o committed (pagamenti automatici al conto). Se il cliente preferisce il mondo ricaricabile riceve meno o paga di più, incentivandolo a spostarsi sull'altro lato della medaglia che aumenterebbe la sua stickness all'offerta. Questo è dovuto dal fatto che il MOP (Method of Payment) è più committed (carta di credito) e che l'offerta concerne anche il fattore del contenuto, entertainment per il privato e soluzione digitale per il business.

M: Ma tra tutti questi cambiamenti e trasformazioni, qual è secondo il tuo punto di vista l'investimento più ingente con cui le telco sono impegnate?

G: La connettività è diventata una commodity ed è impossibile basare un vantaggio competitivo offrendola fine a sé stessa. È anche importante però specificare che la rete tra i diversi operatori cambia di molto nella sua qualità e frequenze licenziate dal Ministero, e, anche se il consumatore finale non differenzia più molto le offerte di connettività, rimane la prima area di investimento per ogni grande operatore. Vodafone e TIM hanno fatto per anni la guerra sulla cosiddetta network superiority. I brand d'asset sono sempre due: la network superiority (linea fissa e mobile) e l'offerta commerciale. Quindi i clienti fanno la scelta tra vari operatori non solo perché gli si offre un servizio di connettività, ma anche perché ad esempio si ha una rete vendita preparata, un'offerta commerciale e una direzione marketing che è molto segmentante sui servizi che offre. È qui la chiave di lettura del mercato. In generale comunque il mondo delle telco è un mercato ad altissima capacità e necessità di investimento, difatti ci sono tanti costi fissi. Per gli investitori ci deve quindi essere la quasi certezza di ottenere un dividendo che dia la possibilità di guadagnare rispetto a tali investimenti. Sono tutti investimenti ad altissimo costo, di conseguenza le telco hanno altissimi margini, circa del 30%, ma per mantenere tali margini bisogna avere una strategia di mantenimento degli stessi o di incremento dei ricavi. Questo può essere fatto tramite l'aumento del valore del cliente o dei prezzi.

M: Per quanto riguarda i servizi abilitati dal 5G, quindi ad esempio all'IoT, voi offrirete anche servizi inerenti?

G: Si, per quanto riguarda l'IoT, sul lato consumer offriamo un portafoglio dedicato chiamato V by Vodafone, tramite il quale siamo leader mondiali nel settore. Sono presenti ad esempio servizi abilitanti tramite la rete dati verso l'utilizzo di applicativi domestici (domotica). Tuttavia, è ancora una fase preliminare. In generale, si tratta di servizi di connessione da casa verso N prodotti. L'idea di base è offrire, tramite un unico operatore – Vodafone – connettività per la casa attraverso la rete dati, inclusa nell'ADSL, e la fibra. Relativamente la linea mobile, essa abiliterà altre tipologie di servizi quali tracking, geolocalizzazione o data analytics. Ci sono anche prodotti per anziani, per animali domestici e dispositivi per auto. Difatti, Vodafone ha acquistato il gruppo Cobra, leader mondiale dell'IoT nel mondo automobilistico, creando Vodafone Automotive. In questo caso è possibile notare che la digitalizzazione dell'automobile

è guidata da un operatore telefonico. Vodafone ha delle partnership quad dove contribuisce con i servizi di connettività IoT per l'auto. Sarà molto importante anche il segmento della pubblica amministrazione, cioè l'abilitazione di dispositivi ospedalieri, di gestione del traffico, delle risorse pubbliche (acqua, luce e gas), dei rifiuti. Esiste anche il ramo giga family che è volto ad incrementare la fidelizzazione del consumatore finale.

M: Per riuscire ad offrire questa fetta di servizi abilitati vi avvarrete di nuovi partner? Come cambierà l'ecosistema Vodafone?

G: Si, molto spesso sono servizi sviluppati con una logica di platforming e partnering: commercializziamo prodotti e servizi creati da altri player sul nostro portafoglio, oppure li creiamo e customizziamo insieme portando dall'una e dall'altra parte competenze e risorse. Ad esempio, si possono attuare partnership con attori particolarmente verticalizzati che ci aiutano a coprire quel gap di conoscenze relative a particolari industrie, Movylo è una di quelle. Infatti, vi sono operatori sul mercato che costruiscono sistemi IT che necessitano della connettività o della rete commerciale di Vodafone per operare efficientemente, di conseguenza ricercando nuove partnership. Tali partner, come Movylo, Google con G-Suite o Microsoft con Office 365, ottengono una royalty sulle vendite dei loro prodotti.

M: E vi basate principalmente su un preciso segmento di customer?

G: Su ramo enterprise abbiamo 3 segmenti principali, i SOHO (Small Office Home Office) – da 1 a 9 addetti –, SME (Small-Medium Enterprise) – dai 10 ai 49 addetti – e Corporate – sopra i 49 addetti. Poi all'interno di questi macro-segmenti ci sono micro-segmentazioni dipendentemente dal verticale in questione, ad esempio agricoltura, bancario, assicurativo, manifattura, turismo, travel, ristorazione e retail. In quest'ultimo è stata attuata un'importante partnership con OVS per lo studio del tracking di negozio.

M: Ho controllato sul vostro sito web il portafoglio di prodotti V by Vodafone per i consumer e lo ritengo davvero molto all'avanguardia. Sul lato business ho analizzato Vodafone Business e ho notato che per corporate offrite anche servizi di consulenza. Di cosa si tratta?

G: Si, dipende dal business del cliente. È un'area molto complessa perché chiaramente sono presenti sul mercato Microsoft, Salesforce, Google che offrono servizi end-to-end sul mondo dei sistemi IT (Salesforce) e del cloud (Microsoft e Google). Bisogna posizionarsi su una nicchia di servizi definiti digital solutions, cioè soluzioni customizzate sul business del cliente. Quindi, non un'offerta a scaffale come quella di Microsoft e Google, bensì soluzioni SaaS. In altre parole, tutto il mondo dei servizi software che creano un valore aggiunto per il business del cliente. Non è un tema di tecnologia, ma di capacità della catena di vendita di saper leggere il bisogno del cliente. Difatti, in questo ambiente competitivo vince la compagnia che ha un agente di vendita che ascolta e comprende le esigenze del cliente. In ogni caso, in Vodafone si sono attuati degli esperimenti relativi al mondo della sanità nei quali i pazienti venivano già "scansionati" in ambulanza tramite le nuove tecnologie e la loro cartella clinica digitale

direttamente inviata all'ospedale per creare un ricovero personalizzato e reattivo. Ci sono una quarantina di esempi di esperimenti che Vodafone ha fatto a Milano.

M: Perfetto, e come cambia la competizione in questo nuovo ecosistema digitale con l'implementazione del 5G e IoT?

G: Nel lato consumer avrai dei competitor relativi principalmente alla parte entertainment. Quindi la Vodafone TV andrà a competere con Sky o Netflix sulla dimensione del contenuto e entertainment. Ovviamente, la connettività non può essere offerta da questi ultimi operatori. Infatti, Vodafone, a differenza di questi ultimi, integra diversi servizi e non offre solo ed esclusivamente il servizio contenutistico. L'arena competitiva del ramo business è completamente diversa. In questo ambiente per le telecom, l'opzione migliore è rappresentata dall'essere solution integrator, quindi i primi competitor sono rappresentati da altre telco posizionate nel ruolo in questione, sia a livello nazionale che internazionale. Da una parte vi sono operatori internazionali che hanno capacità di attuare larga scala sugli investimenti; dall'altra sono presenti tutte le tech companies, come ad esempio Salesforce nel mondo dei sistemi informatici, Microsoft nel mondo dei servizi di productivity e cloud, Google nel mondo dei servizi cloud legato alle digital solutions e tante altre piccole realtà. In Italia abbiamo un'eccellenza chiamata TeamSystem, che è una catena di integrazione a valle molto efficace. La compagnia ha molti suppliers che vendono il servizio – come centri per pc, negozi di informatica –, non presenta una propria forza vendita, tuttavia è molto radicata sul territorio perché lavora su catene di vendita indirette. In più, i suoi commerciali intervengono nella vendita a supporto delle aziende che hanno il contatto con il cliente. Tuttavia, non bisogna focalizzarsi solo sul 5G. Ci sono anche tecnologie legate alla rete fissa come l'SDWAN che permettono come telco di avere molta più competenza verticale sul territorio. Stiamo parlando di soluzioni complesse basate sull'integrazione della connettività della rete fissa e dell'applicazione di una soluzione o di un sistema o di un cloud. Il cliente può sempre acquistare dai vari solution specialist i singoli servizi eliminando la proposition per intera, senza così avvalersi dell'integrazione che può offrire il nuovo operatore come solution integrator. Quello che non può sempre offrire la tech company è un prodotto customizzato con la connettività di rete fissa o mobile inclusa. Quindi la telco può risultare più efficace proprio perché riesce ad integrare e personalizzare l'offerta finale. Altrimenti il cliente sarebbe obbligato ad acquistare singolarmente, con un livello di personalizzazione minimo, la connettività da Vodafone, il cloud da Microsoft etc. Per precisare, le soluzioni sviluppate in-house da Vodafone sono solo il 10% della gamma di servizi, il resto sono servizi sviluppati e integrati tramite partner.

M: Ok capisco, è una prospettiva molto interessante. Prima comunque stavamo parlando del ramo consumer: in questo mercato quali sono i principali competitor?

G: Attuerei un discorso di share of wallet, cioè: un cliente spende 70€ di Sky e 30€ di linea fissa, cosa dovrebbe pianificare Vodafone per conquistarlo? Potrebbe incentivarlo ad eliminare il suo abbonamento Sky, del valore di €70 del suo share of wallet e ad attivare la Vodafone TV per soli €30 in più. In questo modo, il lato contenutistico verrà incluso alla linea fissa portando il cliente a spendere €60 e non più i precedenti €100. L'arena competitiva è composta da competitor diretti ed indiretti. I primi sono coloro che offrono direttamente la connettività, come ad esempio TIM, Fastweb, Wind Tre etc. La parte indiretta invece è caratterizzata da tutti gli

altri player che operano nel campo contenutistico, ad esempio NOW TV di Sky, Netflix e CHILI. È anche corretto precisare che ovviamente se Vodafone vende il servizio Netflix, quest'ultimo riceverà una royalty. Tornando al caso precedente, se il cliente attiva entrambe connettività e offerta contenutistica, abbandonando Sky, Vodafone rappresenterà il 100% del suo share of wallet. Per quanto riguarda il lato business, vale la stessa argomentazione, enfatizzando l'importanza della misura ARPA. È infatti necessario ottenere più profitti per ogni cliente, non solo arricchire la customer base con nuovi profili. Tuttavia, non bisogna dimenticarsi di mantenere costante la quota dei ricavi della parte core con più alta marginalità – mobile del 90% e fissa del 40% circa –, aggiungendo i servizi integrati caratterizzati da inferiori ricavi per la presenza delle royalties. Anche se il margine degli ultimi risulta essere inferiore, è fondamentale introdurli nel portafoglio aziendale poiché permettono all'operatore di essere più rilevante per il cliente, aumentando la sua esperienza con l'azienda e il valore del brand. I key point della strategia di marketing sono la minimizzazione del churn e la massimizzazione di entrambe la stickiness e la soddisfazione del cliente.

M: Ok, benissimo, ho capito tutto perfettamente. Un altro punto molto interessante è relativo alle future sfide che concernono l'implementazione in larga scala del 5G e dell'IoT nel settore delle telecomunicazioni. Che visione hai a riguardo?

G: Secondo il mio personale punto di vista, la grande sfida che gli operatori affronteranno sarà offrire in maniera adeguata servizi customizzati ai clienti finali. Sulla grande scala vinceranno le big tech. Gli MNOs possono essere diversi proprio nell'offerta di pacchetti di prodotti che possano soddisfare necessità altamente specifiche e definite. In questo mercato difatti le telco possono essere più competitive rispetto alle big tech perché costruiscono personalmente la connettività su cui i servizi digitali vengono abilitati. Il punto chiave è quindi la capacità degli operatori di essere segmentanti poiché non possono competere con i servizi massive offerti da Salesforce sui sistemi IT o AWS con i servizi cloud. Questi sono soluzioni legate alla grande scala e che vendono meno del 10% del fatturato. La sfida incrementare il fatturato tramite un costante mantenimento dei ricavi sul core e un raddoppiamento del valore assoluto del peso che i servizi basati sulla connettività hanno sul portafoglio. Il vantaggio che l'operatore possiede è la conoscenza del cliente, della tipologia di rete fissa, di device e del suo potenziale business.

M: Come vedi lo sviluppo del settore della telecomunicazione nel 2030?

G: Nello short-term sicuramente bisognerà attuare le modifiche che stanno prendendo piede ora, quindi l'implementazione in più larga scala di Vodafone Business, Vodafone Automotive, Vodafone TV e V by Vodafone. Le telco devono assolutamente trasformarsi offrendo al cliente un valore aggiunto perché il processo di commoditizzazione andrà a divorare i loro profitti e forza competitiva. Price squizing, commoditization e non-differentiation sono i capisaldi dello scenario "do-nothing", i quali si scontrano con integrazione, trasformazione della catena del valore, del portafoglio di prodotti e dei canali di vendita – quest'ultima rappresenta anche la parte più complessa da cambiare poiché composta principalmente da aziende partner al di fuori della realtà interna –, caratterizzanti lo scenario "do-something". Una cosa sicura è che nel prossimo futuro le soluzioni digitali saranno più pervasive.

M: Ok, è uno spaccato della società futura molto chiaro ed interessante. L'ultima cosa prima di lasciarci: come vedi lo sviluppo tra MNO e MVNO?

G: Le MVNOs non hanno molte possibilità di crescita poiché non attuano ingenti investimenti. Infatti, acquistano la rete da un operatore e creano margine sul delta definito dal prezzo pagato dal cliente e dal costo dell'affitto. Sono attori marginali, in totale in Italia peseranno il 10%. Tuttavia, è un mercato con alti profitti dovuti dai bassi costi e dall'elevato guadagno. In ogni caso, non possedendo infrastrutture, reti o licenze, e non possono di conseguenza diventare una vera minaccia per gli operatori tradizionali.

M: Ti ringrazio davvero molto per tutti questi insight che, oltre ad essere molto utili per la mia tesi, mi interessano davvero tanto personalmente. Grazie ancora e ti auguro una buona giornata.

G: Grazie a te Michele, buona giornata.

IoT Senior Manager – 1 hour

M: Hello Kiritharan, I am writing my thesis which is about 5G and IoT, I am not an engineer, so I do not have a technical background. I am attending the International Master's in Management at Nova SBE, in Lisbon and I would like to understand the strategic implications of the 5G and enabled IoT from a telecommunication industry perspective. Are you still working in the industry? What is your role?

K: Yes, my title is called Senior Strategy Manager for the IoT department and I am leading the team for the strategy, development and execution of IoT business. All what I am saying right now should not be related to my company neither to the IoT department.

M: There is no problem for it, thank you so much to have told it. May I just ask you if I can record the interview in order to ease the transcription?

K: Sure, go ahead.

M: What are, from your perspective, the services that are enabled from the 5G?

K: 5G is only a piece of the IoT because the latter is a system of systems. The IoT starts from the device which has a sort of connectivity (SIM card, Wi-Fi, Bluetooth) that helps gathering relevant data which are processed and analysed in order to get insights. The 3GPP technologies are all the standards that support the IoT technology. 5G is nothing else that that connectivity that makes data move. The tricky part is how data move. One idea of the 5G is that data can move much faster compared with the previous generations of wireless technologies, therefore the latency is very low (below 1ms). An example of application of this principle is autonomous driving, in which you cannot afford latency of some seconds, otherwise the car would crash. 5G is the connectivity layer that enables those kind of use cases with very low latency. You can design and slice the connectivity into the 5G according to your purpose. If you have industrial IoT use cases, in which you need very short but very strong signalling, you can design and slice the network through the 5G. Indeed, most of the people talk about the industrial IoT use cases when they speak of 5G, in which you need a lot of power and a high customization of the connectivity design.

M: Ok, therefore this is the so-called network slicing. But in any case, can we say that the killer application will be the IoT?

K: In my point of view yes, IoT is one of the major services that can be enabled by the 5G.

M: In general, do you think that telecommunication companies have already payed off their investments in the 4G?

K: I think it depends of the country and on the region, you are talking about. I do not agree with the point that 4G investments are already done. In Germany for example there are still several discussions in the regional areas that do not present 4G bandwidths. The investments in 4G and broadband is not done yet. However, when it comes to 5G it is possible to build the new infrastructure on the previous one, exploiting some of the investments carried out with the 4G. This represents the first phase.

M: All right, so moving forward to the most important point of the research: what are the business models that you as a telco want to exploit in order to capture the 5G and IoT opportunity?

K: With 5G the customers of the past models, e.g. automotive, manufacturers, are trying to build their own campus network, creating their own independent infrastructure in their factory. This is one of the major threats that telcos are dealing with, because their core is being duplicated from their business customers in a smaller scale. Telcos have invested a lot in 5G above all in frequencies and spectrum, and in some cases the prices payed for those spectra were much higher than those initially expected. How are the telcos going to monetize that back end to get a return on those investments? In my point of view, I cannot see in the short-term any important killer application in the B2C sector. 5G is about the B2B segment, so all the business customers that are having the use cases discussed before, as the manufacturers, automotive etc. Still, none of the telcos have clearly articulated their 5G business model strategy. One model can be represented by sharing the risks of the 5G. In the past the payment plan was consumption-based in which customers were paying the amount of data that they were using. In the forthcoming future in the scenario in which there is a business customer who deploys 5G use cases to optimize productivity, his payment plan can be defined by the savings provoked by such technology. Indeed, since the telco is the enabler of the financial improvements it will require a share of that value. On the one hand, if the business customer earns more value from the use cases, the telco will be payed more. On the other hand, if the firm earns less the operator will be payed less. There is a sort of risk sharing which can work out because many companies are still struggling to find the right approach, the most successful ones are the most innovative, which are not represented by the majority of players in the market. This is a good opportunity for telcos to reduce the complexity of operations for their customers. "We are not a pure 5G provider, we will be more than that. We will realize end-to-end solutions, going to factories and enabling 5G use cases considering the firms' legacy IT systems. We will analyse your data; we will integrate different services and we will be sure customers can have the whole solution from one provider". This could be a solution for some telcos, but it is not generalized for everyone in the market because one threat is present within such strategy. Indeed, telcos need completely new capabilities which are currently not present within them. Most of the personnel is represented by network engineers and scientific figures. Instead, they would need solution architects, project managers, more generalist figures who can see the pain of the customers and find solutions for it. Therefore, operators must seek these skills in the market, a task which is going be challenging because those professionals feel more comfortable working for IT companies or for more future-oriented businesses (e.g. Tesla). It will be hard to attract those talents and to bind them to the firm.

M: I understand, so these knowledge gaps can be covered from these new employees present in the market. But do you think there will be a lot of verticalization and integration within the industry (e.g. with tech start-ups)?

K: To be honest, it is rather challenging because in the past telcos have not been proving themselves successful in serving verticals. Especially when it comes to IoT, there are specific verticals who have really particular needs, for example the agriculture. The latter registers a lot of potential for IoT applications, but it requires to a deep knowledge and understanding of the sector's issue in order to deliver niche solutions. Start-ups are much leaner, quicker and better in developing business applications that can serve particular needs that telco can never do. Historically speaking, telcos have always been huge organizations without high dynamicity and flexibility. Concretely, in such bureaucratic corporation, the time of developing an idea of business application for a specific use case will take more compared to that one in a start-up. Therefore, the key to win the market is to stipulate partnerships with these new and agile actors. The result will be to deliver services which implicitly have integrated both the consolidated reputation of operators in the business world and the capabilities of these more niche players.

M: Perfect, it is an interesting point of view. Before you have mentioned that business customers are trying to create their own ecosystem, representing a sort of micro-operator. How do you see the relationship between telcos and new competitors in the market, such as the aforementioned micro-operators or the OTTs?

K: Someone who is considered as a competitor in some layers or domains, does not necessarily be a competitor in others. Actually, this is the current situation. Many players were trying to do business in lots of different spaces, just realizing that it is an unfeasible objective. The trend is that companies will get back to their core competences and will focus on them, partnering with other players to attain knowledges required in other industries. Telcos are getting more aware of their own limits and all the services that cannot be covered by their expertise are either outsourced or left to competitors. There are different dimensions that you can observe. One way is to outplay through regulations and lobbying in order to achieve a better competitive position. Nevertheless, this is not a sustainable path in the long-term because no regulation can stop innovation. The other way is to make use of those OTT players, leveraging their own services. For example, Spotify and YouTube are two of the major OTTs in the market and represent an important threat for the telecommunication industry. Therefore, the creation of plans in which data consumptions related to the use of those applications are not charged to the customers is an interesting way to avoid potential problems. In general, OTT players represent a threat for telcos because they create a loss in revenues for particular services, such as SMS or voice (e.g. WhatsApp messaging and calls). Nonetheless, this is the old thinking: revenues are not coming from those services anymore, but from the traffic of data.

M: Going back to the 5G and IoT cases and customers, what can be the lock-in mechanisms in this kind of world?

K: In my personal opinion, I can observe two general lock-in mechanisms, a technical and a commercial one. The technical lock-in concerns the interoperability, defining that some applications would run only with the mutual usage of other specific applications. An example is represented by Apple, which makes hard to customers to switch to other providers. Another abstract example within the IoT ecosystem is the forced bond between connectivity offered by telco X and the device management platform/analytics platform Y. I believe that customers will do not appreciate such mechanism because they need now more than ever flexibility and independency. This phenomenon is already happening and can be depicted by the offering of eSIMs, chips that are integrated in the device and allow clients to shift operators over-the-air without substitute any plastic card. In my opinion, the only effective lock-in for the forthcoming future is the delivery of optimal customer experiences. Therefore, customers would be more convinced to stick with the operators' offering because their overall perception is positive.

M: Ok, perfect, thank you so much. Actually, we mentioned before that there are a lot of challenges in this forthcoming era and one of them is the huge investments required. Do you think there are other new concrete challenges?

K: I forecast a deep transformation of the whole organization because many competences that were previously necessary are now obsolete and operators need to retrain their human resources. Apart from this, I think there will be an important influence on the telcos' processes and IT systems due to the new requirements of the 5G technology. An example is the value-based business model, in which particular objectives can be achieved through trainings of employees towards specific mindsets and ways of work. Such model will radically change because the personnel needs to be more flexible and to start working as consultants, aiming to deeply understand customers' issues and co-create solutions. This aspect will also tackle the IT systems because new requirements will be needed to support these new business models, in terms of pricing, customers communication and management etc.

M: Yes, I agree with this point. But do you think that the investments that you are carrying out in these challenges are focused on particular issues? What are their priorities?

K: This depends on the country. Speaking about Germany, having good coverage over the country has always been an important topic within the telco environment. Therefore, it is one of the major priorities because all the other digital solutions and services rely on it. Moreover, I think that many telcos must embrace the journey to make the skills required for the new generation of wireless technology present in their organizations. This is not a second priority, but they have already started a couple of years ago in order to achieve a good outcome in such issue. The third point regards the market in which there is a major awareness regarding who are the real competitors and who are not. Therefore, it is relevant to invest in new partnerships like joint ventures in order to build stronger and solid ecosystems.

M: But partnering with such a big number of new actors, will it change your value chain position?

K: The value chain position highly depends on telcos and how much resources they allocate for innovations. Some operators are mainly focused on the solely offering of connectivity and, in my opinion, they should stick with that position. Others, instead, are eager to offer more than connectivity, providing dedicated vertical solutions where they focus only on particular sectors and services. For high-premium, very established and rich of investments and resources telcos, it can work the position of providing everything to any kind of segment by building a strong partner network. All these 3 options are feasible for telcos depending on the resources and capabilities that they have.

M: In your opinion what can be the 2025 future development of this industry and how would the position of the telco incumbents be influenced? Will it be strong or weak?

K: I have started my first conversation of 5G in 2013, and when I went to the mobile web congress in 2016, 5G was the hot topic of the event. It is 2020 and we are still only speaking about it, not seeing any player who has really developed 5G use cases for the mass market. When it comes to South Korea, they are a step ahead. But in the European market we are still in the phase of defining and sprinting, and surely during the next years some changes will come, but not as strong as the medias are communicating. Moreover, with COVID-19, everything is slowing down and the 5G use cases under consideration represent a sort of luxury good at this difficult moment. Nevertheless, rationally thinking, we should accelerate these kinds of innovations because they help the society to survive and to manage the risks, allowing a more productive smart working.

M: Thank you so much Kiritharan, your help is really precious for me and it will help my research to gain deeper insights. Good luck for everything and have a great week ahead.

K: Thank you Michele, the pleasure was mine, let me know how it goes. Good luck!

Former Director Strategy and Business Development – 56 minutes

M: Hello Mark, I am Michele, an International Master's in Management student at Nova SBE, in Lisbon, carrying out a thesis on 5G and IoT. Specifically, I am studying the strategic implications on the telecommunication sector concerning these two disruptive technologies. I can see that you work for BT in London.

MH: Hello Michele, nice to meet you. Yes, I am still into the telecommunication industry, but I am actually working for Arcadis, an architecture consulting firm. In any case, I have been working in the telco world for many years and the last role was Director of Strategy and Business Development at BT, being responsible for the Internet of Things (IoT) strategy, specifically on Smart City engagements.

M: That is wonderful, I am sure you have a lot of insights and inputs to give me during this interview. So, what is in your perspective interesting about 5G?

MH: The large part of mobile technologies was aimed to the consumer market. But 5G is probably the first generation of mobile technologies which is predominantly aimed at the corporate market. Firms like system integrators, industry consultants are more likely to be able to understand what the market requirements are and draw down the 5G technology. The dangers for operators are that they will become increasingly marginalized and disconnected from the overall value chain, as well as the mobile architecture is starting to open up. There are opportunities for companies to build up their own 5G network in their factories or campuses, without mobile operators' involvement.

M: I completely agree with you. I have read so many papers about these kinds of micro operators, like manufacturers, big shopping malls, which are able to build their own ecosystem in their infrastructures. But how can they build their own 5G ecosystem without the help of MNOs?

MH: Talking about the fix and fibre market, in UK there are 40 network providers building fibre optic networks, so the market is a highly competitive now. When you look at the mobile market, there are 3-4 operators, typically the same operators of 20 years ago. The reason is because there are significant barriers to entry, such as access to spectrum, which is really expensive and a fine high resource, control over the customer base, so the handsets are hard coded to connect only to the network of your provider, and the cost of building the mobile network infrastructure, such as towers. All those things are very expensive to replicate and you really only success in this market if you are at scale. This is why in the UK market all the 3G operators who were late entrant, have never really got significant traction in the market, they have always struggled for their margins. Therefore, you see organizations like Vodafone, not only growing in specific markets but going and acquire, trying to create scale on a European global basis. Scale really matters. There are lots of things of operators to slow down all the competition. On the spectrum front, in the US the FED has made spectrum, so even though a

mobile operator would buy a license for spectrum, if it is not used in an area, then third parties can sublet it. Moreover, some of the key spectra, the Federal Communication Authority has made it available on a localised basis, making it open to use it from everyone. The spectrum stopped to be a bottleneck. The UK are adopting a similar model: if a company now wants to use some expensive mobile operator spectrum inside a building, it can do it for £80 a year per location. Therefore, the firm can now use expensive spectrum that belong to operators for not a cheap price. The devices that connect to the network are moving towards iSIM or eSIM, which basically means that the functionality of a SIM is becoming increasingly integrated into the chipset of the handset. It means that we will be to change operators really easily. Returning to the previous example, if I enter a building, on its wall there could be a QR code which, once scanned, redirect my phone to connect to the company's network. The devices are becoming a lot less network specific and then on the core network, there is a big movement towards open-access technology. Therefore, there are enterprise like Lime, Nokia and Ericsson who are making core networks in a box, allowing business customers to purchase 1 for only £100,000 weakening the barrier represented by millions of investments to build core networks. Effectively, spectrum devices and radio equipment are becoming open and cheaper.

M: Just to clarify, what is the core network that you can purchase for £100,000?

MH: The core is basically the switching intelligence inside the network. If you think about the functions that a network performs, in the middle of the network it is present the subscriber register, the permissions that the subscriber allowed, and you can understand which southside the subscriber is connected to. Therefore, the core is about all the central functions that you need, such as security and the network functionalities. Indeed, you can purchase all these features as open-source platforms which can be provided by firms as Lime or Ericsson, who are making low costs equipment.

M: I understand that and, in this way, the level of dependency of micro operators towards carriers and incumbents will decrease a lot.

MH: Yes, you can now think about building your own network. Currently, companies provide their own Wi-Fi network into their buildings and campuses. Holding a mobile network in their own plants, make companies able to use voice and data communication, as well as services like smart building infrastructure or robot sensors on production lines. All these operations do not require mobile operators' involvement.

M: You already talked about micro operators, but do you think that with the new 5G ecosystem will there be other new competitors within the market?

MH: Absolutely, there will be companies who will be able to build the network themselves just for their own use. There will also be firms setting up virtual operators who will be able to operate core-as-a-service solutions that will effectively become cloud-based functions. Therefore, their customers will only need to own a radio equipment in their buildings, letting MVNOs manage it. Moreover, enterprises like Amazon, Google and other big tech firms will start to get into the telecommunication area. Businesses might host core-as-a-service on Amazon, which will provide, for example, a gateway for subscribers working inside your building to dialogue and connect to colleagues on the Vodafone network. We are going to see a wide range of new actors. There will be systems integrators close to particular industry segments who will create solutions which use 5G, deploying 3rd party providers to build the infrastructure and the network themselves. Moreover, consultancies are really important in the

future ecosystem. Accenture, for example, have started building platforms and capabilities rather than just providing consulting services. The businesses much closer to system integrators and to the spectrum will understand the market needs and contend the technology into a relevant solution, rather the operators who traditionally were never engaged deeply with applications. Telcos have to invest heavily in building industry empathy and understanding the knowledge but, by my point of view, carriers are not in a good position of carrying out such actions at the moment. Their margins are under pressure, there is a strong focus on building new 5G networks. They have not enough money to invest in building empathy and understanding of specific industry sectors. Therefore, they have to reach out system integrators who understand an industry segment sharply.

M: Ok, awesome. And how the telcos are at least planning to overcome these kinds of challenges and to build these new business models?

MH: I think they certainly are trying to build partnering ecosystems, picking industry sectors that register high growth and high value. For example, there have been a lot of effort for the topic of connected vehicles and Vodafone have been positioned themselves for that market. Their rational is that they have the biggest international footprint of any operator, thereby if an autonomous vehicle works on top of Vodafone network, it will be able to work in several countries. But moving to fields like eSIM, iSIM and soft-programmable SIM, why would car manufacturers preconfigure a car that can work only with one network provider? The main idea should be to enable vehicles to run over every network that is available and reliable. In general, I think that telcos are trying to be very careful about the sector they pick. They are carrying out investments in hiring professionals who understand those industries and can help close the gaps. One of the difficulties of this operators' unclear role is that they can alienate either the market or the channel. Companies like Telefónica started working with some channel partners into a particular market – the industry of black boxes and drive-mode detector to discount insurance payments – and, afterwards, they have decided to enter the insurance field. Therefore, they started competing with companies who they had previously identified as customers. This behaviour alienates the market and the community starts thinking "Can we trust them? Can we work with them?". Indeed, I think that carriers have to be really clear about the role they want to play in the value chain, and they need to be consistent. The other end of the spectrum is represented by picking the role of a pure network player, allowing systems integrators and other market experts to build products on top of telcos' open platform. Thus, operators would turn their networks into easy tools to build applications on top of it. Nevertheless, the clear statement of not going to be system integrators or solution providers into specific industries must be done at the very beginning. This would mean becoming pure play connectivity providers. I think this is a valid model but, typically, operators are concern on becoming disenfranchise from their customers relationships. From an eager point of view, they want to be providing solutions and, to a certain extent, they aim to play such role in 5G environment as well due to huge investments carried out. There is an important issue: if they stop investing in a network, that senses out a bad message to investors and to your customers, driving churn. With 5G they really need to work hard to show the use cases in order to explain the reasons of their network investments, aiming to stimulate further demand. Indeed, the stimulation of the latter will not be as easy as it was for 3G and 4G. 5G will mainly regards ultra-low latency and massive machine-to-machine, which are not consumer features but business.

M: Actually, they want to differentiate themselves because being just a connectivity provider can transform the connectivity in a commodity. What do you think about such statement?

MH: Yes, it commoditizes what they do. Observing the IoT value chain, for an IoT solution there is only about 10% of its value represented by connectivity. If a telco does not address the other part, it would exclude itself from the other 90% of the profit. Typically, in such IoT environment, 25% of the value chain is included in dimensions like solutions, consulting and spectrum. 5G is moving much more into these kinds of environments where connectivity represents only a small part of the value chain and it is substantial to attain the other part of the profit. This is a direction in which operators have never played before, but through the strategy and investments that have been carrying out, they might be able to shift to it

M: Yes, this is an amazing perspective from within the industry. Thus, we can see opportunities for them in the IoT market, should they focus from the beginning in specific sectors?

MH: We can talk about it through an example. In the smart water metering industry, there are several open technologies, such as LoRa, WAN and Sigfox, that have great capabilities and offer better battery performance, cheaper radios and good ecosystems of sensors. Moreover, companies can build them without needing an operator. However, LoRa can be considered as the Wi-Fi of the Internet of Things. For it, there is no need of spectrum, the network equipment is cheap and there is a good ecosystem of sensors' suppliers. Thus, operators risk to be frozen out of the opportunity because they analyse only one solution, neglecting the rest of the opportunities.

M: Hence, they still have to define their position in the value chain. Will we observe these kinds of development during the next years?

MH: I think they will try to disrupt their models, or they will just become commodity connectivity providers. When we look at the bulk of the applications carried on fix and mobile networks, the value of the application, whether is retail or streaming content, goes to Amazon or to Netflix, not to the operator who are basically a commodity carrier of IP packets of data. They are not going to track records of capturing the OTT revenues. I personally believe that with 5G the main actors, instead of being Netflix or Amazon, will be Accenture and similar consultancies who will capture the value in creating industry valuable applications.

M: Ok that is a really interesting perspective. Regarding the customers do you think that the IoT will be more focused on the consumer or the corporate side of the market?

MH: It is an interesting matter. I personally think that IoT will be applied in both homes and businesses. On the one hand, there is a real connectivity opportunity in habitations since there are strong connections through Bluetooth and Wi-Fi. Hence, smart home will surely grow as a market. Nevertheless, it is expected also to increase the resistance intrusive technologies like Alexa, which listen to and record most of people's habits. This is an important issue which can lead consumers to not adopt connected devices. In my opinion, the market is taking off slower than people expected, nonetheless it will grow with momentum. However, the most important opportunity of the large implementation of IoT resides in the business enterprises and in all the applications of it concerning them, e.g. optimization of production, understanding customers' use of products and transformation of service delivery models. Therefore, there is a strong idea of servicification. An example is Volvo trucks optimizing their cost per mile per transport knowing how much couriers are carrying in their vehicles, what type of truck they are driving and how full it is. This is also the reason why I believe that consultancies are well positioned in such market, because they have proved to be really professional at understanding the real business challenge and, afterwards, looking for technological solutions. Until now, carriers'

approach was to build great networks without a clear idea of how to deploy it besides the mere connectivity. Indeed, it is more a technology push rather than demand pull perspective.

M: Yes, but it is hard for telcos to change their business into a more consulting-based one. Would not be more likely that they create partnering programs with actors like Accenture, Bain and BCG?

MH: Yes, but most telco have already tried the consultancy field because, whilst they can see the logic of partnering, they still peevishly look at the margins that they are handing out. If instead you look it from a consultant point of view: do you need a partnership with someone who provide a commodity component when actually what you really want to do is force those firms to compete with your business? If a company sell an Accenture solution, will the end customer be concerned on which network the service relies on? Probably not, as long as the Service Level Guarantee is met. Therefore, whilst you can see that they hold different roles in the value chain, they might converge. In commercial motives, it means that partnerships are quite difficult and telcos operators still have a view that they are capable providing consulting services.

M: How are they going to overcome this challenge?

MH: This answer is still uncertain. I believe that telcos do not have a high amount of money to spend disrupting their businesses and that they will rather go for the partnership option. Although, it can be possible that we will end up in a hybrid situation where operators pick a few industries that are really important for their business, and build vertical capabilities – hiring people from those industries or carrying out acquisitions of start-ups that have an established foothold in such markets – and then work with partners to enter market sectors that are less critical for them. I think we will deal with this blended approach. Nevertheless, the most successful option would be to focus on their core businesses and become optimal telecommunication partners for highly experience channels which serve particular sectors.

M: Ok, amazing view of a potential future model. Just the last question about these partnerships with consultancy firms: will telco have a low bargaining power towards consultancy firms?

MH: Yes, exactly. If telcos will only work with “bits and bytes”, the service levels are consistent, but the leverage is not high. The only way they can enhance their competitive position in such environment make it easy for customers to build applications on top of their networks, through open access platforms, wide range of APIs, application libraries etc. The aim is to increase their ability to be easily integrated with other systems. This could be an interesting model for carriers, but the problem is that they are stuck in the middle. Indeed, they aspire to be more than they are now, they aspire to attract and trap some of the value at the higher levels of the value chain. Therefore, it makes very hard for them to make a rational decision of becoming simple utility providers.

M: We are mostly talking about the global telecommunication companies, but how do you see the development of the relationship between the global and local carriers?

MH: You can observe firms like Telefónica and Vodafone that are very proactive in what it is called the open vRAN movement, which is defined as the opening up of telcos' architecture to support third party networks. With this move, instead of risking that lots of firms set their own competitive and independent network, telcos offer them their network support. Carriers recognized the risk and the opportunity of the phenomenon and are trying to react to it. The strategy thus is characterized by the fact that if incumbents are not able to beat them, at least the competitors become a wholesale customer. The only reason you would set up an MVNO is because you have something unique, which could be represented by a sharp understanding of specific groups of customers.

M: Yes, that is true. And what are the potential lock-in mechanisms in order to keep those customers in a 5G and IoT perspective?

MH: It depends on how deep are the activities provided. For example, if a carrier just offers the IoT network, moving bits of information deriving from sensors and transmitting them to the client's server, it would be easily substitutable. On the other side, there is the operator who provides devices, analysis and insights of collected data, installation, management, fix and battery change services, also executing similar solutions of a consulting firm. For instance, if a network provider offers information on water leakages in a precise area, it will be harder for customers to switch to other providers who can offers the same information and insights. Therefore, it will be all about how the operators resist the pressure towards commoditization in a way that is credible. Telcos will unlikely become industry specialists. They either build deep-lasting partnerships with key suppliers into industry ecosystems, having strategic relationships with them and working together, or retreat into offering a commodity network which make it easy for customers to build on it and integrate applications. Therefore, they need to enhance, in both ways, customer experience and customization level for each solution. As abovementioned, they might pick industries with high potential, such as, considering the current sanitary situation, tele-care.

M: What are the other important challenges in such next interconnected ecosystem?

MH: One of the major challenges will be the general regulatory environment in which telcos operate. Moreover, the movement towards commoditization will create a seamless pressure towards cost optimization and universal service obligations. It will almost become a human right to have a broadband connection. There are significant state expectations in terms of coverage and reach of the network, of its performance and its cost. The regulatory environment is constantly tilted against major incumbents to try stimulating competition. This commoditization will represent a huge driver for them, and it will be difficult to maintain investments level on the network with the pressure on margins. It seems ever more like utilities. The other key point is understanding the pace of the process of decreasing their systems' costs with AI technologies, network function virtualization and software defined applications in order

to replace expensive radio planners and resources. Another challenge would be integrating together different technologies, creating common infrastructures to decrease expenses. Moreover, as we move towards the ultra-high frequency spectrum, which has huge carrying capacity working on very short distance, there will be a need to drop down street level of radio deployment. Small cells are going to become a requirement at some stage, and health considerations appear as threats. People are starting to become really nervous about radio stations: on the 4th of April four 5G stations were burned due to COVID conspiracy theories. Telcos need to densify that network and build more small radio sites down at the street level. The technological and cost challenges associated with street level network are going to be a major headache for operators.

M: What are the dimensions that are more prioritized in terms of investments?

MH: Operators, particularly actors like BT, build fibre network and 5G network, trying to rationalize and consolidate the technology to reduce costs. The other key point that represents an important burden for telco operators is that they are carrying a massive pension liability with the old civil service government employers. Therefore, the earnings of telecommunication companies are getting hugely impacted from high pensions that are a drain over the cash flows.

M: By your perspective how do you see the development of the telecommunication industry in the 2025?

MH: I think there will be more niche players specialized in particular use cases. The telecommunication sector will be transformed into an embedded fragmented market and will become integrated into industries rather than being a clearly defined sector of businesses that perform very narrow functions.

M: All right, that is a really good point. And due to this digitalization, are telcos going to decrease the physical stores that they have?

MH: That is inevitable. In a way with the devices becoming homogeneous, tangibility is becoming less important. The higher and enhanced digital customer experiences will surely decrease the number of physical stores. Telcos will feel that such big expenses can be easily avoided through the higher digital experience.

M: Ok, that was perfectly what I was expecting. Mark, thank you so much for all your help and I wish you all the best for your career and life, above all in such a difficult period.

MH: Thanks to you Michele, I wish you good luck for your studies and I hope it was useful.

Head B2B Product Strategy at Telefónica – 46 minutes

M: Hello, I am Michele, a master's in management student at Nova SBE, in Lisbon, carrying out a thesis on 5G and IoT. Specifically, I am studying the strategic implications on the telecommunication sector concerning these two disruptive technologies. I can see that you work for Telefónica in Madrid.

A: Yes, I have more than 10 years of experience in telecommunications and business in Latin America and Europe. Currently, I am the Head of B2B Product Strategy at Telefónica and I basically analyse all the opportunities and the evolutions of value proposition focused on 5G.

M: Ok, thank you for your introduction. From your perspective, what are the services that are getting enabled through the 5G implementation?

A: The 5G will enable a zero-latency connection and, besides other services, a phenomenon called network slicing. As a consequence, these technologies will be milestones for new use cases, mainly focused on the industrial IoT. One of the most important will be autonomous driving enriched with in-vehicle entertainment, defining not only a new mean of transportation but of entertainment. 5G will also enhance the performances of AR and VR which could be deployed in remote control and support, remote surgery or diagnostic. For manufacturing it will be enabled smart factories, namely human-to-robotic collaborations through which all within plants will be connected. In utilities, 5G and IoT will provoke low-power data and longer devices' battery life, radically decreasing expenses. For today's use cases, LoRa, NB-IoT and LPWAN are better mainly for the lower costs. Nevertheless, 5G will be the evolution of such technologies it will own the capability to build stronger ecosystems. In two or three years, when all the applications, sensors and systems will be implemented, 5G and IoT will take place over the abovementioned technologies.

M: Perfect, there will be lots of use cases enabled from just one set of technology. But what will be the position of telecommunication companies in these new use cases? What are the potential new strategies that are going to be applied?

A: Telecommunication providers are not only focusing on connectivity. They are trying to build ecosystems, like platforms, through which they provide the best connectivity enriched with several applications to build the use cases before cited. For example, Telefónica for the IoT environment will sell the NB-IoT principle together with applications provided by partners. Therefore, carriers provide their services, their connectivity, their IoT and analytics skills, with also solutions developed by partners. With 5G this model will explode.

M: Therefore, there will be more partnerships, and partnering programs. Although, I imagine that there will also be some solutions developed only from the telcos, is not it?

A: My understanding is that with 4G, new companies, APIs and telecomputing the market is already dense, and all the technologies have been democratize in every sector. Telcos can develop internally some application, but they can also leverage on different start-ups and other vertical partners that will support them to enhance their innovation.

M: Ok, perfect, and what do you think about the relationships between telcos, OTT and micro-operators?

A: I think this represents an ecosystem. I personally do not look at OTTs as competitors of telecommunication companies. In my point of view, the relationship will be characterized in the forthcoming years with high cooperation between actors. An example is Telefónica that has different agreements with Netflix, AWS and Microsoft to support each other in different industries. In any case, with 5G partnerships will not only regards OTTs and tech giants but also well-verticalized start-ups.

M: Therefore, talking about partners and competition, who will the future competitors of telecommunication companies be? Will the competitive landscape change or will it stabilize?

A: The landscape will surely change because 5G is composed by a several different parts. In the scenario in which there are so many non-homogeneous pieces, a good amount of new and niche players will enter the industry. Instead of traditional vendors, we might see start-ups running their businesses without any equipment, relying everything on the cloud. Nevertheless, 5G requires spectrum purchased from the government, creating a huge entry barrier. For instance, the lack of spectrum and infrastructure made MVNO companies in a good but not best position within the 5G ecosystem. Indeed, from another perspective, MVNOs are really efficient due to their low CAPEX investments. Therefore, the relationship between MNOs and MVNOs will be characterized as a win-win situation.

M: Insightful perspective, thank you. And who do you think will be the customers of such ecosystem for telecommunication companies? Will they be more end-consumers or enterprises?

A: It will depend, we still don’t have the killer application for 5G and IoT. By my perspective, in the B2C segment the killer application will be AR and VR, providing different omnichannel experiences. Here, the timeframe to find such market keys is going to be approximately 2 years. Regarding the B2B market, instead, the killer application will come first because these technologies are more oriented towards enterprises than end-consumers. In such market the timeframe to clarify what will be the mainstream applications is going to be 6 months, maximum 1 year. In this sector, MNOs can run fixed wireless access, that provides connectivity to customers using their 5G networks, allowing a way more companies to have a fast speed connection.

M: Yes, but regarding the connection, now it is getting commoditized and its value is decreasing substantially. How do you see this phenomenon?

A: With 5G you will have different quality experience. In Spain, for example, there is more fibre deployed in comparison with other European countries, included UK and Italy. This is important, because the Spanish population will need a different kind of connectivity in order to run the applications that I have mentioned before. Therefore, connectivity will be a key in the future, above all with 5G and IoT large scale implementation, and it is been a key since a lot of years already. In conclusion, the value of connectivity also highly depends on the culture of the country. In US, for example, it is a way more expensive than in Europe.

M: If the connectivity is getting commoditized, how would you be able to lock-in customers?

A: I personally believe that when an operator provides good services and quality, integrating in one single place all the partners and ecosystems, it is not necessary to build strict mechanisms to lock your customers. Instead, it is important for them to remain open and flexible, without forcing customers to stick with them – a path that registers the opposite effect. In general, 5G will bring to customers new and more valuable experiences, giving them the possibility to customize not only the offer but also the application and the use of it.

M: Perfect. Moving to the last part of the interview. What is your perspective regarding the challenges that telcos are – or have to – dealing with now and in the forthcoming years?

A: The most important challenge is to have efficiencies regarding the investments that telecommunication companies need to carry out in the coming years, not only for the spectrum but also for the network deployment. I think this will change the whole ecosystem. The priorities of such investments are the spectrum and network deployment, as well as the research of the killer application and the creation of the 5G ecosystem around the core connectivity. Furthermore, another important challenge is to have all the new actors abovementioned working together to build a sustainable competitive advantage and a consolidate ecosystem. Regarding the data instead, when you can provide them to your customers, and they can decide what to do with them, it will be a better situation. With 5G telco will have more clients' information, but if the latter are delivered fairly to the customers, avoiding any immoral usage of them, I do not see any problem concerning privacy

M: This is an optimistic view regarding the regulatory system, I really hope it will be like that. Anyway, what is your personal view of the industry in 2025 and how the relationship between global and local carriers will develop?

A: I think that in 2025 5G and IoT will be mainstream. All these companies will work together, trying to be more efficient and detailed. Moreover, they will work also with customers to provide them new and disruptive experiences. In general, I see that the market will get more

consolidated, but it will depend on the local regulator; in US for example there are only two or three important MNOs on the market, a scarce number compared with the actors present in EU.

M: Ok, perfect, the interview is finished. I would love to thank you so much for all your help and I truly wish you all the best for your career and life, above all in such a difficult period.

A: Thanks to you Michele, I wish you good luck for your studies and I hope it was useful. If you need any help just drop me an email.

Academic Professor – 32 minutes

M: Hello professor, can we start with the questionnaire that I have sent you? Moreover, I would like to ask you if I can record the interview to ease the transcription of it later on.

MZ: Yes, sure, go ahead.

M: Perfect. You are working in the telecommunication industry since 2006, what is your expertise?

MZ: Yes, I am specialized in spectrum management, in specific technology policy for telecommunication. Currently I am working at the United Nations University.

M: Thank you for your quick introduction. Do you think that MNOs have already payed-off their 4G investments?

MZ: No, not yet. Operators have invested billions of dollars in 4G and such huge investment would take at least 10 years to get payed off.

M: Do you think there are some concerns regarding this fast-technological shift?

MZ: No, I do not. The reason of such belief is that even though the technology is already being launched in both research and industry spaces, industry players show that in order to entirely introduce in the market a certain technology, the latter must have a good level of maturity. Moreover, another factor that support the complete technology introduction is the degree of "welcoming" characterizing each country. I personally believe that most of the markets currently need only a limited amount of such fast and disruptive technologies. If we observe the industry from a number of subscribers and growth rate perspective, 2G is still the leader. 3G and 4G did not take up fast and 5G will certainly slow to be completely implemented considering also the current socio-economic crisis.

M: Ok, I understand the point. Moving forward, what do you think are the services enabled by the 5G and what are the most promising ones?

MZ: I would say there are two perspectives about 5G: the speed side and latency side. There will be a lot of changes coming up in terms of the network sooner that we expect, such as

mMIMO, edge computing and small cells networks. Moreover, small pockets within urban dense areas will be deployed in order to offer to the community 5G wireless connectivity. I personally believe that the automotive industry might be one of the most important markets for telecommunication services after the large-scale implementation of 5G and IoT. It is possible to think about clash collusion prevention mechanisms or, in general, cars with 5G-enabled communication devices. There might be also use cases present in surveillance industry. Nonetheless, the milestone of 5G will be IoT.

M: Therefore, regarding the IoT, what will be the strategy that telecommunication companies will apply in order to enter into specific IoT markets?

MZ: It depends. For instance, it is present a possibility that telco companies might start sharing cells. The cause is rooted by the fact that the number of cells required by the 5G network development is overwhelming for only one firm. Therefore, the infrastructure is at the base of everything and it will be necessary to cover the whole urban territory. With such strategic move, telcos will seek partners to split the costs associated to new network deployment.

M: Indeed, I have seen lots of telecommunication joint ventures aiming to share the 5G infrastructure development costs. But do you think that the MNOs will have different position in the value chain, are they going to provide something else beyond the solely connectivity?

MZ: It depends because the telecommunication world probably does not make sense. The reason of such statement is that currently the whole system of model designing, and service delivery has changed. When we imagine about telecommunication, we imagine about provisioning of network and of data. Instead, if we talk about cloud or edge, we think about deploying value to provide infrastructures, which is not a traditional telecommunication path. Thereby, corporations which were offering network infrastructure will be digitally transformed, also providing entertainment content. In general, there is a huge potential for transformation residing inside telco organizations. The double perspective is: businesses will only be offering infrastructures, cancelling all sorts of services and letting other firms play on top of their technologies; or businesses will be working in verticals, competing in different horizons. Nevertheless, the most realistic scenario is that carriers will be specialized in different verticals, sharing the costs with partners. This last point is substantial due to the investments are huge and they are characterized by a low ROI.

M: Yes, I understand, it is an insightful perspective. And what do you think will be the most promising revenue streams caused by the 5G and IoT opportunity?

MZ: I personally believe that the most promising revenue stream will be intrinsic to video calls. Currently, considering the crisis, people are constantly getting on a video conference with

colleagues, friends and families. Another substantial high-grow opportunity could be the gaming industry with immersive technologies.

M: What do you think will be the segment of customers on which telecommunication companies – offering services beyond the mere connectivity – will focus more?

MZ: The enterprise is the most important customer segment for 5G and IoT and a potential lock-in mechanisms could be an effective and focused marketing activity.

M: Yes, that was a notion that I have found also in the other experts' opinions. In any case, how do you think telecommunication companies will create new clusters of innovation and will enhance their innovation roll-out?

MZ: Basically, most of the biggest telecommunication companies are spending in R&D, which is the most important strategy to enhance innovation roll-out. Operators would be able to better understand the market if, instead of spending in marketing, they focus more resources in such division. Most of the times, firms roll their innovations into markets that have not been understood completely. Imagine you are a 3G company back in 2009; if you have stopped to invest in the 3G technology until now, destinating all the funds accumulated to 5G projects, you would have been in an optimal position. Nevertheless, such behaviour is not possible to be observed in the real market because decision makers study the competition, trying to follow or anticipate it. Investments in R&D are the key, and those can be carried out through relationships with universities, for example.

M: Moving forward, do you think there will be major disruptions within the competitive landscape?

MZ: 5G will democratize the market, deleting all the possibilities to create strong monopolies.

M: What will be the most important challenges for MNOs due to 5G and IoT?

MZ: The anticipation of the killer service for the 5G is the most important key to discover.

M: Ok, perfect, we are done. I would love to thank you so much for all your help and I truly wish you all the best for your career and life, above all in such a difficult period.

MZ: Thanks to you Michele, I am looking forward to reading your paper.