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How to Catch a Unicorn

An exploration of the universe of tech companies with high market capitalisation

Author: Jean Paul Simon
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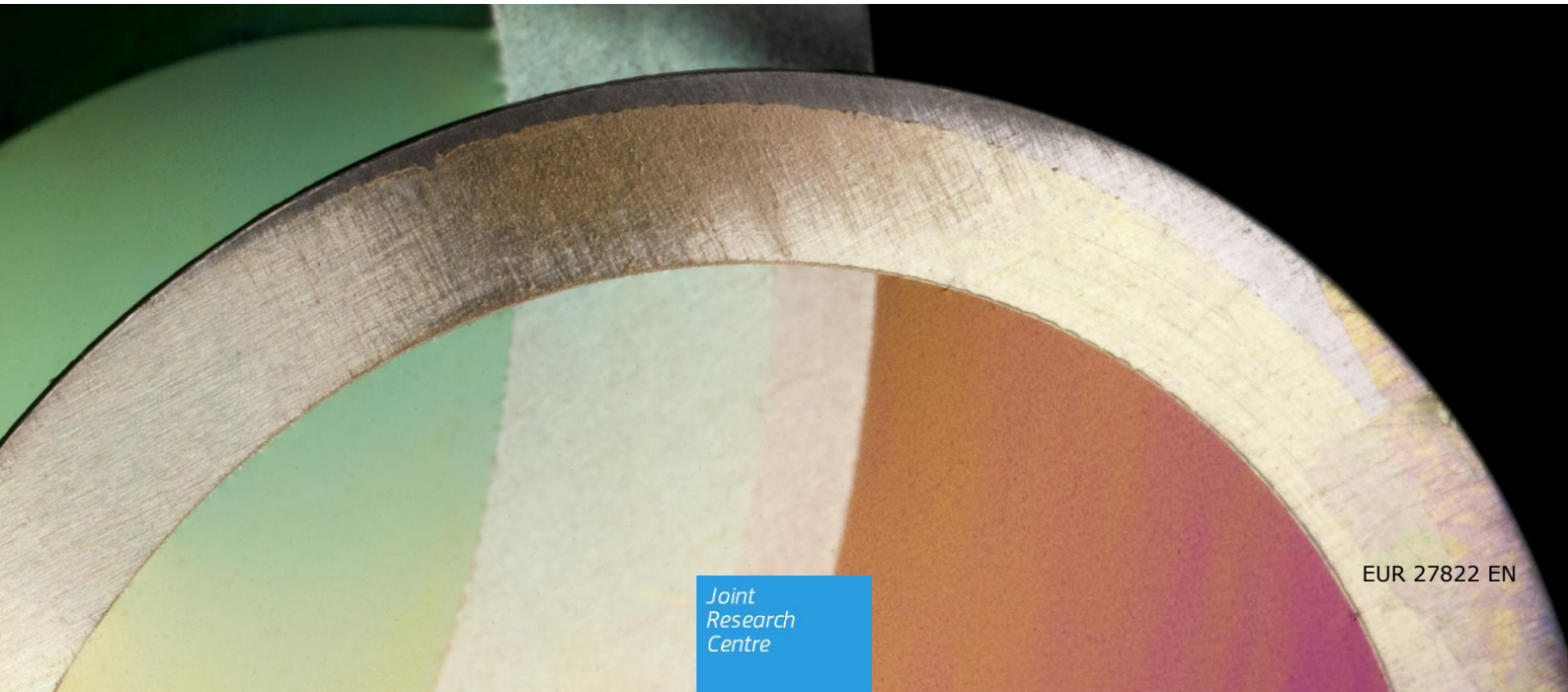

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PART II – Case Studies is available as a separate document

Preface

This report was prepared in the context of the three-year research project on European Innovation Policies for the Digital Shift (EURIPIDIS), jointly launched in 2013 by JRC-IPTS and DG CONNECT of the European Commission. EURIPIDIS aims to improve understanding of innovation in the ICT sector and of ICT-enabled innovation in the rest of the economy.

The project's objective is to provide evidence-based support to the policies, instruments and measurement needs of DG CONNECT for enhancing ICT Innovation in Europe, in the context of the Digital Single Market for Europe and of the ICT priority of Horizon 2020. It focuses on the improvement of the transfer of best research ideas to the market.

EURIPIDIS aims to:

1. better understand how ICT innovation works, at the level of actors such as firms, and also of the ICT "innovation system" in the EU;
2. assess the EU's current ICT innovation performance, by attempting to measure ICT innovation in Europe and by measuring the impact of existing policies and instruments (such as FP7 and Horizon 2020); and
3. explore and suggest how policy makers could make ICT innovation in the EU work better.

The report is available as two separate documents – Part I contains an analysis of innovative tech companies with high market capitalisation, which is based on investigation of a qualitative sample of 30 case studies, see Part II.

Abstract

Technology companies with high market capitalisation (often called unicorns) have been receiving a lot of attention and media coverage recently.

In general, unicorns are IT-centric (software mostly, but also hardware). They are often rather young global companies that match unsatisfied demand with supply through the production (which can easily be scaled up) of innovative and usually affordable services and products. These are usually part of the mobile internet wave, and rely on connectivity (high speed networks, mobile and fixed), new devices (smartphones, tablets, phablets…) and the opportunities these bring. They are grounded in network effects, and demand-side economies of scale and scope. They depend on a strong favourable business environment, developing organically and building on fast expanding markets (emerging economies, middle classes). They are Venture Capital-dependent and the competition for funding can generate impressive (i.e. inflated) valuations. These companies can be disruptive for other sectors and firms.

This report aims to document the phenomenon by investigating a qualitative sample of 30 companies that have recently been valued above the one billion dollar threshold. It identifies some of their characteristics and the lessons to be learnt. The report has two parts: Part I contains the overall findings of the investigation and some suggestions for policy makers. Part II contains a detailed account of the case studies on which the investigation is based. They are published as separate documents.

Executive Summary

Technology companies with high market capitalisation (often called unicorns) have been receiving a lot of attention and media coverage recently. The current hype does not fully reflect reality and is often a simplification. To start with, unicorns are heterogeneous: they are strongly defined by their financial aspects, and though these may have some common traits, they are generally very diverse in terms of developments across sectors, business models, organisational and growth models, etc.

This report aims to document the phenomenon by investigating a qualitative sample of 30 companies[1] that have recently been valued above the billion dollar threshold. This is a simple exploratory exercise that cannot capture all aspects of unicorns. It does, however, identify some of their characteristics, offer speculative interpretations and discuss lessons learned.

The report is based on a review of dedicated literature[2], technical journals and trade press articles, and on the analysis of annual reports of publicly-traded companies. The publicly available information is scarce and highly heterogeneous. However, what has been gathered allows us to make some observations about these companies:

1. Most of the companies in the sample grew organically, while only a few grew by acquiring new businesses in mergers, acquisitions or take-overs.
2. Unicorns all rely to some extent on venture capital for their initial funding, their developments, and their exits. The extent to which they need VC funds varies according to the strategy they adopt. For instance, an organic growth strategy requires less money than an inorganic model.
3. The founders are often "serial entrepreneurs" who have created other companies before. Most of them are seasoned business people with strong academic backgrounds.
4. Many unicorns have a significant level of R&D expenditure. 11 out 23 of the companies sampled are among the top global 2,500 R&D investors (in 2014).

Overall, these observations and the information found in each case study (Part II of this report contains the case studies) point to two hypotheses as regards the conditions in which the unicorn phenomenon developed:

- Fully-fledged and fast evolving mobile internet networks had emerged, supported by the mobile internet wave, and increased device capabilities. These factors, combined with faster, higher bandwidth and more intelligent networks, paved the way to the wide adoption of advanced multimedia applications. As handsets become cheaper, and data connections more affordable, this phenomenon has gained pace. It allows access to a wide range of new apps, building on changes in patterns of consumption. It is moving from legacy push models to pull models, and is consumer driven and data centric.
- Currently, the economy is undergoing a transformation, which the report calls the third phase of convergence. This means "*the transformation of everything else*", that is the digital transformation of what makes up most of the economy. This is likely to include the sectors less affected up until now by this transformation. Peer-to-peer services, such as Uber, bridge the digital and the physical worlds in novel ways. The companies in our sample are extending the realm of products and services offered.

These hypotheses, illustrated by the heterogeneous universe of unicorns, allow us to discuss some potential implications for innovation policies:

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1 23 unicorns and 7 "gems".

2 Atomico (2014, and 2015), Bloomberg/FT (2014), Ezratty (2014), Fortune (2015), A.Lee (2013, 2015), Gilles and Marchandise (2013), Wall Street Journal (2015).

1. The development of unicorns is clearly market-led and does not appear to be the result of specific policies, at least directly. Indirect support, however, seems highly important. These companies benefited from existing measures like tax shelter, special support for SMEs in the EU and in the US, support to infrastructures, etc. Support for the business environment seems to have been crucial: for example, access to capital and also to the expertise needed from universities and research centres (some of the unicorns were spin-offs from labs).
2. The mobile wave has also been market-led. Most of the policies in the EU and the US were designed for the fixed telecommunications markets, to liberalize the sector or to regulate it. However, the outcomes have been different on each side of the Atlantic. One can then ask the question: did the EU miss the mobile turn? Was this because too much focus had been put on the deployment of new networks such as ultrahigh broadband? The question is relevant not only from the point of view of policy but also manufacturing.
3. As regards competition and regulations, the newcomers often operate in grey areas. Legacy players claim they are facing unfair competition from players that do not abide by the same rules and that the newcomers benefit from these asymmetries of regulation. All the companies in the sample claim they provide new services that were not possible or even blocked by incumbents which acted as gate-keepers. They claim that the incumbents are simply trying to bar new rivals and new business models.
4. Inevitably, change brings a wide range of business disruptions, and some of the sample - e.g. Airbnb, Amazon, or Uber - are perceived as disruptors. The question is whether digitization means positive disruption ("creative destruction") or negative disruption (job losses). It is unclear whether the disrupters bring harm and whether incumbent outputs have been diminished. The economic debate is, by and large, dominated by sheer rhetoric, not evidence. Protecting incumbent businesses is likely to be a short-term strategy. At the same time, striking a balance between technological innovation and the protection of existing rights is a challenging task for policy makers.

Part II of this report provides company-level information, in so far as it is available, for each of the case studies. To facilitate information gathering and allow comparisons, information on each of the case studies is presented under the following standard headings: Corporate History, Corporate Structure, Business Model, Financial Data, Leadership, and References.

Chapter 1 introduces the sample.

Chapter 2 puts forward the lessons that can be learned from the sample and provides a synthesis of some features. It introduces the models of growth identified in the study of company documents. It then looks at the companies from a wider angle and investigates their business environment (access to finance, background of founders). Finally, it summarises what is known about their R&D expenditures.

Chapter 3 puts the unicorns into a broader perspective so as to better explain the phenomenon. First it focuses on the way these companies have, in one way or another, built on the latest technological wave - the mobile wave. Then it explores the way the companies in the sample are having an impact on the various sectors of the economy.

Chapter 4 reviews the policy implications.

PART 1: An exploration of the universe of tech companies with high market capitalisation

1. The age of unicorns

This report looks at technology companies with high market capitalisation, focusing on two types: young companies and more established companies. Young companies are less than 10 years old. All of these companies have had their market capitalization valued, at some stage in their life-cycle, at one billion dollars.

Venture capital practitioners have identified these criteria on the basis of experience and experimentation. In 2013, Aileen Lee wrote a post in Tech Crunch about companies born after 2003 that have been valued, at some stage in their life-cycles at a very high threshold of market capitalization. She called them Unicorns.

Since then, a number of other publications have looked at young and high market capitalisation companies. These publications include Atomico (2014, and 2015), Bloomberg/FT (2014), Ezratty (2014), Fortune (2015), A. Lee (2013, 2015), Gilles and Marchandise (2013), Wall Street Journal[3] (2015). They have chosen a USD 1 billion market cap threshold, offer justifications for doing so. However, it is worth sounding an initial note of caution: although the 1 billion market cap is an attractive way to track companies, the market valuation per se may not be the best way to assess the economic value of a company. Market valuation is another tale of inventive metrics (see Box 1 on market cap and Box 3 on financial bubbles).

Box 1: Market capitalization and enterprise value: a tale of inventive metrics

Market capitalization (market cap) is the (theoretical) total market value a buyer would have to pay for the whole company, the total market value of the shares of a publicly-traded company. It is equal to the share price times the number of shares. Most of the documents quoted in this report refer to market cap. Valuation of the firm is often used and relates rather to market cap, although it may not be precise enough. As the value varies according to the changes in share prices on the Stock Exchanges where companies are listed, it is highly volatile. It should be added that stock prices are about expectations, not performance.

The market cap criterion receives a lot of media coverage as it provides a simple and often impressive indicator. For example, Apple has a market cap of USD 758.85 billion (YahooFinance, 2015). But market caps fluctuate by nature according to the whim of the financial markets, and may be affected by all kinds of "irrational exuberance". This is why investment gurus like Warren Buffet explicitly advise not to go for a valuation of this kind, nor to invest in unheard of start-ups. Instead, he advises investing in solid well-known brands that may or may not be undervalued and underrated.

Another value is the "enterprise value": the theoretical takeover price. It is more comprehensive than market cap, which only includes common equity. Enterprise value is calculated as the market cap plus debt, minority interest and preferred shares, minus total cash and cash equivalents. To give an example, as of April 2015, Twitter's market cap was valued at USD 33.26 billion and its enterprise value was USD 30.96 billion.

From a micro-economics or business management viewpoint, other criteria like revenues, EBITDA (a measure of operating profit and net income), and, of course, profit provide sound figures. Whenever these data are available, they have been fed into the case studies accompanying this report (Part II).

Furthermore, while market cap in theory represents the value of future revenue streams or dividends, it does not necessarily reflect the current situation. For instance, Uber with

[3] The report co-produced with Dow Jones, "The Billion Dollar Start-up Club", is an interactive dataset.

a revenue of just $1.2 billion was once valued at $18 billion, about 16 times its earning. "*Uber's valuation alone trumps the Gross Domestic Product (GDP) of countries like Iceland, Zimbabwe and Haiti combined*." Mangalindan (2015). However, leaked numbers, published earlier this year by Bloomberg, showed that the Uber company had losses of $470 million on sales of $415 million (DeAmicis, 2015).

The discrepancy between actual revenues and capitalisation can be dumbfounding: without any "sizable revenues" (Chavez, 2014), Cyanogen was valued at nearly USD 1 billion. Its CEO even claimed optimistically but rather oddly: "*We are losing money more efficiently than our nearest competitor* (Hortonworks)." Similarly, Twitter had impressive losses of nearly 42% of the year's revenue.

"*Silicon Valley is fuelled by fomo: the fear of missing out*." (Bradshaw, 2015).

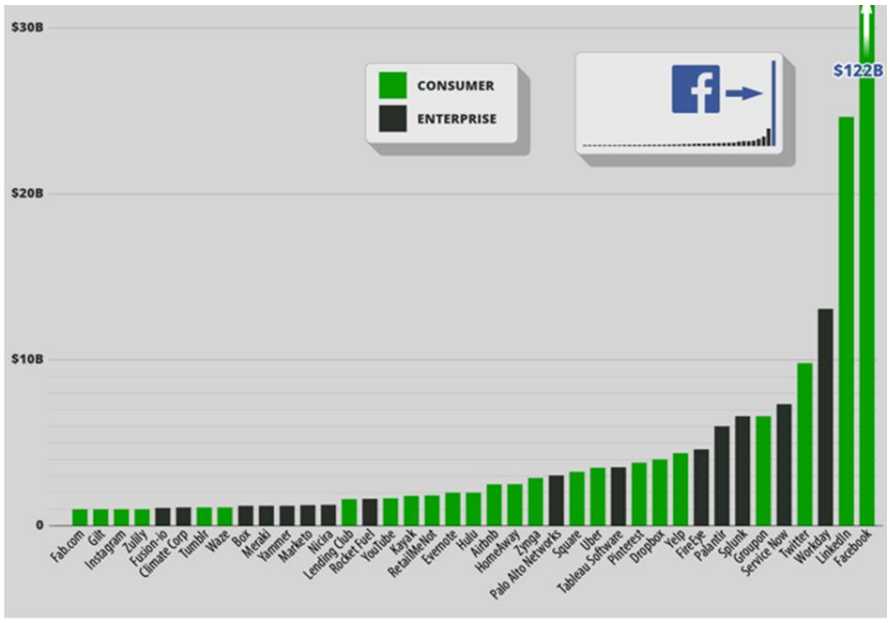
However, standard metrics such as profit after tax (PAT), EBITDA, and cash flow may not be easily applicable to firms that are generating often impressive losses. Therefore, investors came up with a vague valuation metric called annualized gross merchandising value (GMV), or cost of goods sold (Verma and Dalal, 2015, see some data in the Alibaba case study, Part II of this report). In the case of games, investors can use even more "creative" metrics like the number of active users and/or paying users (daily, monthly, see the case study of Zynga, Part II of this report).

Real revenues come from commissions that e-commerce companies get from sellers or listing fees that they charge to list products on their site. This stream of revenues may vary considerably. As noted with the case of Amazon, e-commerce companies often operate with very tight margins (Distinguin, 2014, Simon, 2015). Amazon wins in a volume-based game of aggregating lots of revenues on thin margins, through economies of scale.

Source: compiled by author
www.gurusfocus.com, and http://finance.yahoo.com/q/ks?s=twtr+Key+Statistics

Lee (2013) in her original post identified 39 companies born in the US between 2003 and 2013 that reached the one billion dollar mark. These companies can be seen in Figure 1.

Figure 1: The original 2013 unicorn club



Source: Lee (2013)

Lee (2013) states that:

> *"The NVCA[4] says over 21,000 internet-related companies have been funded since 2005; Mattermark[5] says 24,000; and the CVR[6] says 20,000 companies are angel funded per year. So we assumed a ballpark 60,000 software and Internet companies have been funded in the past decade."*

This contrasts sharply with the fact that she identified only 39 US-based software companies as unicorns in 2013 (see Figure 1, the original 2013 unicorn club.). "*About .07% of venture-backed consumer and enterprise software start-ups become unicorns*" (Lee, 2013), 0.14% for the 182 unicorns identified worldwide in 2015. This is why she adds: "*it's really hard, and highly unlikely, to build or invest in a billion dollar company*"; hence her using the term "unicorn" to describe *"something extremely rare, and magical*".

Other publications have attempted to go further with these observations, but instead of focusing like Lee on the US, they opened their investigations globally. The Atomico list is the most comprehensive and consistent among the various sources investigated for this study. Atomico provides a database of companies on which a sample can be built: Atomico[7] (2015) identifies 182 such companies worldwide (see Box 2). The Atomico report also focuses on young companies (less than 10 years old).

Box 2: The Atomico report

Atomico is an international venture capital firm that invests in technology companies around the world. It claims to help the world's most "disruptive technology companies" to scale up and reach their full potential globally. Atomico was co-founded in 2006 by Kazaa and Skype co-founder, Niklas Zennström.

In 2014, Atomico released an analysis of the 146 companies globally that have reached the billion-dollar mark over the past decade. In May 2015, the updated report documents 182 unicorns. The report is an interactive dataset, which has been updated on a regular basis (quarterly since January 2015).

The dataset gathered by the report contains information on 182 software companies, i.e. "*Companies where the primary business value is derived from software- and/or Internet-driven products or services"* founded since 2003 that have broken the billion-dollar valuation barrier at one point in time. The dataset results from a very broad range of publicly available sources, relying heavily on historical news stories and company press releases to identify the dates and details of billion-dollar valuation events.

The report acknowledges a series of judgments the authors of the Atomico report made about what should and should not be included:

- *"First, in order to give us a 10-year horizon on data and trends, we include companies that were founded in 2003 or later.*
- *Second, we include companies where the primary business value is derived from software- and/or Internet-driven products or services. This includes both consumer and enterprise focused companies and e-commerce businesses.*
- *Third, we include companies that have at one point in time reached a total valuation of USD 1 billion or higher through any of the following events:*
  - *Private market valuation, so long as it has been publicly disclosed. We do not include companies where there has been no public confirmation of the company having achieved a billion-dollar valuation through a private market*

[4] US National Capital Venture Association: http://www.nvca.org/
[5] Data-driven marketing deal making: http://mattermark.com/
[6] Center Venture Research publishes angel market analysis reports: https://paulcollege.unh.edu/research/center-venture-research
[7] We used several editions of the interactive report and observed some discrepancies between numbers

placement. This means that we're missing some familiar names that you might expect to see, such as LINE, Outbrain or Privalia[8]*.*

- *M&A.*
- *Public market valuation - i.e. via IPO".*

As the report concentrates on software companies, it does not include hardware-driven businesses linked to software such as handset manufacturers. For instance it explicitly excludes Xiaomi "*since hardware is central to the company*." The report recognizes that a "*grey area exists for companies which produce hardware but whose overall value proposition is heavily dependent on software"*.

The 182 companies are distributed across the following 15 sectors defined by Atomico: Adtech (4 companies), Classified Directories (10 companies), Content (12), Content consumer app (6), E-commerce/retail (40), Education (1), Enterprise app (36), Enterprise data and infrastructure (10), Financial services (14), Food & drink (4), Gaming (16), Healthcare (4), Security (9), Social (20), Travel & transportation (11).

The report reveals that the E-commerce sector leads with 40 companies, followed by enterprise app sector with 36 companies, then social with 19, and gaming with 15. Education lags behind, as does the food & drink sector. Healthcare is also an underpenetrated sector. In terms of type of business; 68% (123) of the companies are consumer-focused businesses, but with significant regional variations: for instance, 95% of the 39 companies from China are consumer-focused.

It also reveals that globally China, with 39 companies, ranks n°2 behind the US, and takes the lead for e-commerce (11 companies out of 32). A similar position is achieved with the gaming activity (5 companies out of 15), but half the game companies come from Asia.

Source: http://www.atomico.com/ https://www.crunchbase.com/organization/atomico#/entity

This report uses the one billion dollar and 10 year thresholds only as a starting point. It also includes other high market capitalisation companies. It investigates older companies[9] to see how longevity affects high market capitalisation. It also includes "gems" or young companies that have not quite reached the market capitalisation threshold in order to observe the growth path of (potential) high market capitalisation companies.

This chapter first explains how the company sample was constructed. Then it describes some of the features observed within these companies.

1.1 The sample

Criteria

The sample in this report was not intended to be statistically representative. Its aim was to provide enough diversity (but not comprehensive) to explore some of the main features of the high market cap phenomenon. Case studies have also been included in this report (Part II) in order to bring qualitative elements to the analysis.

[8] Rovio, however, the Finnish creator of the game "Angry Birds", although founded in 2003, is an example of a company that is not included in the Atomico list with no clear explanation as to why. The company went public in 2012 and has a market cap hovering around USD 4.2 billion (WSJ, 2014, but no precise data available). At the time of its IPO, Rovio was estimated to be worth USD 6 - 8 billion by analysts in 2012.

[9] GAFA companies as suggested by the IPTS.

Tables 1 and 2 provide the full sample of companies. Our sample was built around 4 criteria: **sector, age, geographic location, and financial**. To make this work comparable to previous work, it follows similar criteria.[10]

The **sector** categories follow the previous literature on high market capitalization. Specifically, Lee (2013, 2015) categorizes companies according to their business model. She distinguishes between (1) consumer companies, where the primary customer is a consumer and (2) enterprise companies. Each category is further divided into two: consumer companies are divided into e-commerce companies and audience business models; and enterprise companies are divided into "Software as a Service" (SaaS) companies and enterprise business. She defines the 4 resulting business model categories as follows:

1. Consumer companies:
    - E-commerce: companies where a consumer pays for a good or service through the internet or mobile: e.g. Uber and Airbnb;
    - Audience: free for consumers, monetization through ads or leads (the freemium model is important for apps such as games): e.g. Twitter.
2. Enterprise business companies:
    - SaaS: users pay (often via a "freemium" model) for cloud-based software, Akamai is the leading provider of cloud;
    - Enterprise: companies pay for larger scale software: e.g. Criteo.

Atomico (see Box 2) uses different sector categories: e-commerce, enterprise app, social, gaming, etc. For completeness, we have tried to include companies from all business model categories and sectors (Atomico & Lee).

The **age** category has been set **above/below 10 year old** in order to follow the literature. The sample attempts to draw a **global sample**: **companies from every region**. Finally, the **financial criterion** revolves around the **USD 1 billion valuation**. This criterion has obvious drawbacks that are discussed in more details in Box 1.

Sample

The 23 unicorns in our initial sample can be regrouped in two set of companies: (1) companies 10 years old or younger with a USD 1 billion market valuation; (2) older companies with high market valuation over USD 1 billion. The following paragraphs explain in more detail how these companies were selected.

The first set of companies proposed by A. Lee (see Figure 1: The original 2013 unicorn club) concentrated on US-based software companies. The Atomico report (2014, 2015) recognises the global spread of these software companies but takes into consideration a ten year period only.

1. Our first set of 13 "young" companies was selected out of the Atomico 2015 report: Airbnb, Cloudera, Criteo, Flipkart, Garena, KakaoTalk, King.com[11], Rocket Internet, Spotify, Twitter, Uber, Xiaomi, Zynga. These companies were chosen because they were young tech companies with high capitalisation, from a large variety of sectors.

   The companies were selected globally, with a bias towards EU companies: Criteo, King, Rocket Internet, Spotify. In addition, the European fast growing e-commerce company, Allegro (1999),[12] was identified during the investigation and included in the sample.

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[10] For more details explaining these criteria, we refer the reader to the work of Lee (2013, 2015) and Atomico (2014, 2015).

[11] Early bird, King is like a generational outlier in this category

[12] Even if its market cap was lower than the threshold.

2. A second set of 10 "old" companies included Google (1998), Apple (1976), Facebook (2004) 13 , and Amazon (1994). These four companies are often referred to as GAFA[14]. Some would not have qualified as unicorns within the first 10 years of their existence. However as Table 1 reveals, they are now leading companies in terms of market cap, and provide a useful benchmark.

In addition to the above four companies, we included the Chinese generational equivalent of the GAFA group to balance the sample geographically. These were the BAT [15]companies (Alibaba (1999), Baidu (2000) and Tencent (1998)).

Since Allegro (Poland)[16], and Tencent (China, see below) were included in our sample and both are subsidiaries of Naspers (South Africa), the third largest global player in e-commerce, this company (1915) was also included. Shazam (1999) was also included as an example of an "old" European software company.

Finally, to cover all business models as described by Lee, we also included Akamai (1998), a US-based "Software as a Service" company. Table 1 presents these 23 companies, categorized by business model (as per Lee (2013, 2015)) and ordered by region and market capitalization.

Table 1: Distribution of the sample of 23 selected unicorns
By business model and region, ranked by market cap (2014)

Company	Year created	Market cap, billion USD unless otherwise indicated (2014[17])[18]	Revenues	Profit (-/+)	Number of employees
Consumer companies: e-commerce					
US					
Apple	1976	USD 737.54 / **231. 8**	USD 183 billion	++	92600 +
Google	1998	USD 362.56/ **131**	USD 66 billion	++	40000
Facebook	2004	USD 226.37/ **17.89**	USD 12.46 billion	+	6337
Amazon	1994	USD198.28/ **54.5**	USD 88.98 billion	-/+	117300
Uber	2009	USD 41	USD 415 million	**--**	1000/ 5000
Airbnb	2008	USD 10	USD 45 million	-	600 +
Asia					
Alibaba[19]	1999	USD 204	USD 8.4 billion	+	22072
Tencent	1998	USD 200	EUR 12 billion	**++**	27 690
Baidu	2010	USD 71.58	USD 7.9 billion	++	40500
Xiaomi	2010	USD 46	RMB 74.3 billion (around EUR 11 billion)	**+**	8000
Flipkart	2007	USD 3 in 2014 USD 15 expected end of 2015	Rs 28.46 billion (around EUR 413 million)	-	20 000

13 Latecomer, Facebook is a generational outlier in this category
14 Google, Amazon, Facebook, Apple.
15 Baidu, Alibaba, Tencent.
16 40 million users, 100 e-commerce-related websites.
17 If year differs it appears in the table.
18 2015, for GAFA companies, the second figure (in bold) gives the total assets.
19 We have included Alibaba under the "consumer companies" category as an e-commerce company which seems logical as the company claims to be the largest online and mobile commerce company. However, at the same time, the Chinese global leader makes it clear to be a B2B and not a consumer oriented company.

Europe					
Rocket Internet (Germany)	2007	EUR 2.6 billion	EUR 137.9 million	**-**	1 282
RoW					
Naspers (South Africa)	1915	EUR 64 billion	EUR 105 billion	+	28000[20]
Consumer companies: audience					
US	2006				
Twitter	2007	USD 33.25	USD 1.4 billion	**- -**	3. 638
Zynga	2007	USD 2.27	USD 690 million	-	2000+/-
Asia	2006				
KakaoTalk (South Korea)	2009	USD 5	USD 203 million	+	700 +
Garena (Singapore)	2009	USD 2.5	USD 200 million	NA + likely	2000+
EU	2006				
Spotify (Sweden)	2003	USD 8.4	USD 747 million (2013)	-	NA
King.com (Sweden/UK)	1999	USD 5.28	USD 2.6 billion	**+**	600+
Shazam (UK)	1999	EUR 1 billion	GBP 9 million	**-**	200
Enterprise companies: SaaS	2008				
US					
Akamai	2005	USD 13.42	USD 1.96 billion	**+**	5105
Enterprise companies: Enterprise					
US					
Cloudera	2008	USD 1.2	USD 100 million	-	701
EU					
Criteo (e)	2005	USD 1.8	EUR 612 million (2013)	+	1300

Source: compiled by the author from references listed in the case studies, companies' websites, as well as from Atomico (2014, 2015), Crunchbase, CBInsights.

3. Our third set of companies complements the set of unicorns. It is composed of "young" companies (10 years old or younger) with market valuations estimated just below the one billion dollar threshold. We identified 7 "close-to-becoming" unicorns and called them "Gems" (see Table 2). We did not include these 7 companies in Table 1 as most of the data in the columns would be missing. These companies are private companies that do not disclose their annual reports. Two out of the 7 companies, Cyanogen and Storm8, are thought to be the closest to the billion market cap (see case studies, in Part II).

[20] Excluding associates and joint ventures.

Table 2: 7 Gems

Company	Year of foundation	Market Cap	Revenues	Business model	Number of employees
US					
Flurry (US)[21]	2005	NA	NA	Enterprise	NA
Cyanogen (US)	2009	USD 1 billion	NA	Enterprise	NA
Storm8 (US)	2009	USD 1 billion	400-500 (estimated for 2011)	Consumer	NA
AppAnnie (US)	2010	NA	NA	Enterprise	300+
Meerkat (US)	2015	NA	NA	Consumer	NA
Asia					
Yodo1 (China)	2011	NA	NA	Consumer	NA
EU					
Buongiono (Italy/Japan)	1999	NA	EUR 239 million (2011)22	Consumer	600 (2015)

Source: compiled by the author from references listed in the case studies, companies' websites, and Crunchbase.

In total, 30 companies were included in the sample:

- US: 10 unicorns and 5 gems
- Asia: 7 unicorns (India, Singapore, South Korea and 4 for China) and 1 gem (China)
- EU: 5 unicorns for the EU (France, Germany, UK and 2 for Sweden) and 1 gem (Italy/Japan).
- Africa: 1 unicorn.

Table 3 categorizes our 23 unicorns according to Lee's (2013) business model categories.

Table 3: The distribution of the 23 unicorns of the sample according to the main business models classification of Lee

Business Model	Companies (US) (10)	Companies (Asia) (7)	Companies (EU) (5)	Companies (ROW) (1)
Consumer companies *E-commerce*	Airbnb, Amazon, Apple, Facebook, Google, Uber,	Alibaba, Baidu, Flipkart, Tencent, Xiaomi.	Rocket Internet,	Naspers Group
Audience	Twitter, Zynga	Kakao Talk, Garena	King, Shazam, Spotify	
Enterprise business companies *SaaS*				
Enterprise	Akamai Cloudera		Criteo	

Source: author's assessment

Table 4 shows all 30 companies according to the sectoral distribution used by Atomico (2015). Table 4 incorporates the gems.

[21] Flurry was acquired by Yahoo in 2014.

[22] Buongiorno went public in 2003 but for an undisclosed account. The company was acquired, later in 2012, by the Japanese telecom operator NTT Docomo, for an amount estimated between EUR 200 and 300 million. The annual report does not break down the revenues of the subsidiaries.

Table 4: The distribution of the full sample of 30 companies[23] according to the sector classification of Atomico

Sector	Companies in this report categorised per sector (Gems included)	Number of companies from this report	Number of companies in the Atomico report	Companies listed per sector in the Atomico report (2014)
Adtech	Criteo	EU: 1	US: 2 EU: 1 Asia: 1	AppNexus (US), **Criteo (France),** InMobi (India), Rocket Fuel (US)
Content	Buongiorno Shazam Spotify	EU: 3	US: 2 Asia: 6 EU: 2	91 Wireless (China), Baofeng (China), iQiyi (China) LeTV (China), Magic Leap (China), Shutterstock (US), Soundcloud (Germany), **Spotify (Sweden),** YouTube (US), Youku (China)
E-commerce/ retail	Alibaba Amazon Apple Baidu Flipkart Google Naspers Rocket Internet Tencent	US: 3 China: 3 India: 1 EU: 1 Africa:1	US: 11 EU: 5 Asia: 16	55tuan (China), Autohome (China), Beibei.com (China), Coupang (South Korea), Etsy (US), Fab (US), Fanli (China), Farfetch (UK), **Flipkart (India),** Gilt (US), Groupon (US), Home 24 (Germany), Houzz (US), Instacart (US), JD.com (China), JustFab (US), Koudai (China), Lemabang (China), Lashou.com (China), Lazada (Malyasia), LivingSocial (US), Meituan (China), Mogujie (China), Powa Technologies (US), RetailMeNot (UK), **Rocket Internet (Germany),** Snapdeal (India), VANCL (China), VIPshop (China) Warby Parker (US), Zalando (Germany), Zulily (US)
Enterprise data and infrastructure	Akamai AppAnnie Cloudera Cyanogen Flurry	5 (US)	US: 11	**Cloudera (US),** Docker (US), Fusion 10 (US), HortonWorks (US), Mongo DB (US), Nicera (US), Nimble Storage (US), Nutanix (US), Pure Storage (US), Soft Layer (US),

[23] Xiaomi is not included as it escapes the Atomico categorization designed for software companies.

Gaming	Garena King Storm8 Yodo1 Zynga	US: 2 Asia: 2 EU:1	US: 4 EU: 3 Asia: 8	Changyou (China), Colopl (Japan), **Garena (Singapore),** Gree (Japan), Kabam (US), **King.com (Sweden),** Machine Zone (US), Mojang (Sweden), Oculus VR (US), Ourpalm (China), Perfect World (China), Supercell (Finland), Youzu Interactive (China), ZQGames (China), **Zynga (US)**
Social	Facebook Kakao Meerkat Twitter	US: 3 Asia: 1	US: 13 EU: 1 Asia: 4 RoW: 2	**Facebook (US)**, Instagram (US), **Kakao (South Korea)**, LinkedIn (US), Mobli (Israel), Momo (China), Nextdoor (US), Pinterest (US), Sina Weibo (China), Skype (Sweden), Slack (US), Snapchat (US), Tango (US), Tumblr (US), **Twitter (US)**, Vkontakte (Russia), WhatsApp (US), YY (China), Yammer (US)
Travel & transportation	Airbnb Uber	US: 2	US: 3 EU: 1 Asia: 4 RoW: 1	**AirBnB (US),** BlaBlaCar (France), Didi Dache (China), HomeAway (US), Kayak (US), Kuadi Dache (China), Olacabs (India), Qunar (China), Uber (US), Waze (Israel).

Source: author's assessment and Atomico report (2014).

Box 3: Skyrocketing fund-raising: the unicorn bubble?

The revenue gap? Looking for "sizable revenues"

The phenomenon of skyrocketing fund-raising and valuations has been described by O. Ezratty (2014) as "Uberisation"[24]. This phenomenon cannot but remind us of what happened with the "dot.com bubble", the "*irrational exuberance*[25]" to quote the then Federal Reserve Board Chairman, Alan Greenspan, and more recently with the financial crisis (the subprimes bubble). This raises a question about the sustainability of the unicorn phenomena. Similarities are being noted, and numerous analysts are stressing the risk of another financial bubble. They highlight these huge valuations, pointing out that the valuations commanded by these companies still need to match up with the revenues they are bringing in now, or will bring in, in the future (Saxena, 2015).

The Chinese VC market also seems also to be bullish, as indicated - not without caution - by CEOs of leading Chinese companies (Custer 2015a, b[26]). In April 2015, Baidu's CEO, Li, told China's Securities Regulatory Commission: "*Everybody knows that right now the start-up scene is very hot. All kinds of VCs are camped out in the coffee shops around Baidu HQ, talking with our employees and trying to get them to leave and do start-ups. What do they think a golden start-up team is? It's a Baidu tech guy, a Tencent product guy, and an Alibaba operations guy. For these kinds of people, getting start-up funding is very easy*" (Custer, 2015a)[27]. Hubris?

However, VC KPCB claims that, in 2013, technology IPOs and venture funding were far below the peak level of 1999-2000 (around 70% lower: KPCB, 2014 report: 22-23). The IPO data from Jay Ritter's website (University of Florida)[28] confirms this assessment.

Fluctuating valuations

While 1 billion can seem as arbitrary as any round number, it can seem even more capricious when we look at it more closely. High market valuations can be poor predictors. "*Uber's valuation does not guarantee it will be the next long-term superstar.*" (Ramadan et al, 2014). Furthermore, private valuations can disagree with public valuations and when unicorns go public, they can experience a pullback as happened with Facebook.

This also happened to King. After the huge success of its hit mobile game *Candy Crush Saga*, King Digital Entertainment went public in 2014. However, its IPO failed to attract the expected amount, and shares fell (Entis, 2014). Finally, the company raised a sound USD 500 million in March 2014 (Bischoff, 2015). Interestingly, the same thing happened with another mobile game company, Zynga (the maker of *FarmVille*) which had a successful floatation, when it was valued at around USD 7 billion. Then, however, shares prices fell by 80% until 2012 (see Annual Report, 2012: 28, 2013: 38, and case study, Part II of this report).

There are other examples: Hortonworks (an open-source software company) initially valued at USD 1 billion by private investors only reached a market cap of USD 666 million when it went public in December 2014 (Griffith and Primac, 2015). To give

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[24] Schlafman (2015) speaks of "Uberification" of the US economy.

[25] In a speech given at the American Enterprise Institute during the Dot-com bubble of the 1990s. The phrase was interpreted as a warning that the market might be somewhat overvalued.

[26] JD.com CEO.

[27] Custer (2015c) reports another anecdote about China's red-hot start-up scene: "*One of the latest (and most unusual) start-ups to get funding is a mobile app aimed at China's dancing grannies – the old ladies you see group dancing in supermarket parking lots and parks. Laugh if you want, but the app just pulled in "millions" in RMB (hundreds of thousands of US dollars, at least) from" a VC arm of the Wuhan Economic Development Group and a Shenzhen-based VC called The Dreamchaser Fund"*.

[28] https://site.warrington.ufl.edu/ritter/ipo-data/

another example outside the sample, companies can have a "down round", as happened with LivingSocial[29]. The company's assessed value fell from USD 5.7 billion to nearly a quarter of that in 2013 (Shontell, 2013, Tantry, 2015).

At the same time, a trio of San Francisco-based experts[30] at Play Bigger Advisors, have identified two trends that may account for the bold size and increase of valuations. The first is the decrease in "time to market cap" (Figures 2 and 3): for VC-backed technology start-ups created since 2009, "*the rate at which their values have risen is three times faster today compared to just a decade ago*". On average, 14 companies have reached a billion-dollar valuation each year in the past decade according to Atomico (2014). Their average time to reach this valuation has been six years from founding. It should be noted that 2007 was a vintage founding year, with the most billion-dollar companies (25 companies). Ramadan et al (2014) state that, for the moment, "*Uber has become the time to market cap champ*". The trend may be observable, but it does not mean it may not signal some kind of bubbling up.

The second trend is that there is a "*winner takes all dimension*" in new tech markets, which are being dominated by one company. Ramadan et al label the "*companies that define, develop and dominate new markets*" as 'category kings'. According to VC investor Salomon (2015) "*Valuation tends to accrue in non-linear fashion, favouring the leader".* He gives the example of Salesforce.com which is worth over USD 40 billion, whereas its once worthy, but slightly smaller, adversary UpShot sold to Oracle for under USD 100 million.

Armageddon and cockroaches

The 40% drop experienced in August 2015 on the Shanghai exchange (China's 'Black Monday') brought a touch of pessimism. A financial pundit noted "*In the event of nuclear economic Armageddon, unicorns might just return to being an endangered species once more, and the only things left will be cockroaches and early-stage start-ups*"(Hall[31], 2015).

In a deteriorated economic environment, exits are likely to become more difficult, especially at these mushrooming amounts. Outsized valuations, especially if those valuations cannot be reasonably tied to revenues as noted earlier, may be far more difficult to sustain. As tweeted by another famous investor, B. Gurley[32] (quoted by Hall): "*we may be nearing the end of a cycle where growth is valued more than profitability*". An open question.

[29] Founded in 2007: an app for Android smartphones to check for daily special deals and offers in a city. The CEO resigned and the company was bailed out by Amazon, an initial investor in the company.

[30] Al Ramadan, Christopher Lochhead and Dave Peterson are partners at Play Bigger Advisors, a San Francisco-based firm that coaches technology executives to build market-leading companies.

[31] From the VC Golden Gate Ventures.

[32] Bill Gurley from Benchmark, considered as one of 'technology's top dealmakers' invested in Uber, see appendix, list of investors.

2. Analytica: main observations

This chapter brings together the main observations on the case studies (See Part II). The first section introduces models of growth mentioned in the documents available for each company. The following section looks at the companies from a wider angle and investigates the business environment of the "unicorns" (access to finance, background of founders). The last section gathers information on their R&D expenditures.

2.1 Growth models: organic v. inorganic (M&A)

If one looks at the growth models adopted, the companies in the sample can be split into two groups: those with organic growth (OG) and those with inorganic growth (mergers and acquisitions (M&A)).

The companies which adopted the first model (OG) achieved growth by increasing output and enhancing sales. Most of the companies we looked at are growing with the high-tech markets in which they operate: their business expands with the market. Companies in the second group grow through the acquisition of new businesses by way of mergers, acquisitions and take-overs.

Table 5 indicates the main approach taken by the 23 unicorns, ranked by region and market caps. It should be noted that companies often blend the two approaches, either historically (starting to acquire companies after a period based on organic growth: Google, Facebook, Apple) or synchronically. Hence, we have classified each company according to what appears to be its "dominant" model. For instance, the GAFA companies Apple and Amazon appear to have grown mostly organically. Google and Facebook, however, have grown mostly through investments and acquisitions.

When a company blends the two models, it is often difficult to assess whether a targeted company was bought mainly so that the buyer could acquire a technology (rather than develop the technology in-house), or so that it could grow by acquiring markets shares from the company bought. For instance, in 2012, Akamai bought its rival Cotendo[33] and acquired, that same year, Blaze Software, a company that owns a technology which can help to accelerate the speed of websites[34]. Some companies, however, have stuck to a single model: for example, Xiaomi or Zynga have consistently opted for organic growth, whereas Flipkart and Rocket Internet have chosen to grow through mergers and acquisitions.

A number of companies have blended organic growth and mergers and acquisitions, either in the same period or after a certain amount of time, as illustrated by Tencent investing in South Asian companies. Both Alibaba and Xiaomi are inking partnerships to enter the Indian market. Xiaomi announced its intention to become an "Indian company" by establishing a start-up, with local R&D and manufacturing in India (Waring, 2015a). In April 2015, Indian investor and industry leader Tata invested in Xiaomi. Xiaomi continues to grow organically, but at the same time it is investing in more and more start-ups, especially in the burgeoning business of smart homes.

Most Asian companies opt for the organic model, which seems to be close to a "standard" model for industrial growth. Often starting in their home country, these companies are betting on the expansion of demand-driven markets, driven by:

- growth of the mobile market,[35]
- emerging economies,
- emerging middle-classes[36],
- and young customers.

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[33] A smaller Israeli rival.
[34] And optimizes load times while cutting bandwidth costs.
[35] With the exception of Indian Flipkart.
[36] China's middle class reached 109 million in 2015, and overtook the US's for the first time ever, according to a Credit Suisse report released 13 October (quoted by Huang, 2015).

Table 5: Models of growth of unicorns, ranked by region and market caps (2014)

Company	Organic Growth model (OG)	Mergers and Acquisition model (M&A)	Profit (+/-)
US			
Apple (1976)	OG		++
Google (1978)		MA	++
Amazon (1994)	OG		-/+
Akamai (1998)	OG		+
Facebook (2004)		MA	+
Twitter (2006)	OG		--
Zynga (2007)	OG		-
Airbnb (2008)	OG		-
Cloudera (2008)	OG		-
Uber (2009)	OG		--
Asia			
Tencent (1998)	OG		++
Alibaba (1999)	OG		++
Baidu (2000)	OG		++
Kakao Talk (2006)	OG		+
Flipkart (2007)		MA	--
Garena (2009)	OG		n.a.
Xiaomi (2010)	OG		+
EU			
Shazam (1999)	OG		-
King.com (2003)	OG		+
Criteo (2005)	OG		+
Spotify (2006)	OG		-
Rocket Internet (2007)		MA	--
RoW			
Naspers (1915)		MA	++

Source: Crunchbase, compiled by the author.

2.1.1 A dominant organic and two-steps growth model

Companies that opt for organic growth are often technology-centric companies like Xiaomi, Tencent, and other games companies like King. 18 companies in our sample have adopted this model, but even among these companies there are many differences. We identified two main approaches: which approach these companies took depended on which market they first entered.

First, some companies opted to enter the global market from the outset. For example, Criteo built on its original tailored technology (the Criteo Engine: multiple machine learning algorithms) and had a global reach from its inception. Akamai and Cloudera

clearly aimed at the global market from the start. Games companies Kind and Zynga, also had global strategies, and rode the mobile wave to distribute their games worldwide.

Second, some companies elected to grow organically by first introducing their product in their home market and then expanding globally. We refer to this approach as the two-step approach, often called a lead market strategy (Beise, 2004, see Box 4).

One reason for taking a two-step approach may be the size of the domestic market in which companies launch their first products: the Chinese market and the US market offer large opportunities for an initial development.

Box 4: Lead markets

The two-step approach: a lead market strategy

Lead Market is a term used in innovation theory and denotes a country or region, which pioneers the successful adoption of an innovative design. It sends a signal to other markets which are lagging behind, which helps to trigger a process of global diffusion. Marian Beise, one of the foremost propounders of this theory states: "Innovations that have been successful with local users in lead markets have a higher potential of becoming adopted world-wide than any other design preferred in other countries"

Source: Beise, (2004)

Chinese firms have been able to capture a significant portion of the global smartphone market and Internet services by simply capitalizing on their massive domestic market. These companies are highly profitable as illustrated by Table 6.

For instance, KakaoTalk has most of its user base in its home country Korea. It is a good example of a company which has tried to benefit from first-mover-advantage by building a strong enough customer base at home before entering other markets, as it is doing now in South-Asia. Similarly, Xiaomi is now addressing foreign markets after growing in its home market.[37] The way to achieve international expansion may differ over time and space, but the target remains the same. It is probably significant that the founder of Singapore's[38] games company, Garena, named his company using a play on words: "global arena".

The only example of a country-by-country market strategy is Spotify. This is probably due to the constraints of copyright negotiations, and the fact that rights holders negotiate rights on a geographical basis, market by market, claiming that demand is territorial.[39]

Their global ambitions form a striking aspect of these high market capitalization companies.

In our sample, the US and Asian companies have generally opted for a two-step strategy, supported by their large domestic markets.

The EU companies in our sample have all opted for a one-step strategy. Surprisingly, these companies did not specifically target the EU internal market even though it is made up of 500 million people, and offers substantial opportunities for the sale of digital products and services. Table 6 attempts to allocate our unicorns to the "one step" group or the "two steps" group and also gives some indication (proxies) of the size of their market.

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[37] Its new Chinese competitor, One Plus, went global in 2013.

[38] A small market (population: around 5.5 million) for sure, but a significant international IT hub. The company has 28 million monthly active users.

[39] Similarly, CEO Reed Hastings announced early in 2016 the launch of Netflix's streaming services in 130 more countries. This demonstrates the global ambitions of these companies, even though they are obliged by copyright laws to solve the issues one country at a time.

Table 6: Market strategy of unicorns[40]

Companies	1 step	2 steps	Size of market[41]
US			
Airbnb		x	25 million guests, in 34 000 cities, 190 countries
Akamai		x	Serves top 30 media and entertainment companies. 170 000 servers in more than 1 300 networks and over 100 countries.
Amazon		x	10 online marketplaces, 2 in North America, 5 in Europe, 3 in Asia.
Apple		x	460 retail stores in 17 countries and an online store available in 39 countries.
Cloudera	x		20 countries, 1 400 partners
Facebook		x	1.248 billion active users
Google		x	More than 100 languages and in more than 50 countries
Twitter		x	288 million active users
Uber	x		56 countries, 200 cities
Zynga	x		100 million monthly users
ASIA			
Alibaba		x	255 million active buyers worldwide
Baidu		x	642 million users
Flipkart		x	26 million registered users
Garena		x	17 million monthly active users on PC, 11 on mobile
Kakao		x	140 million users
Tencent		x	QQ 848 million active users WeChat 549 million active users N°1 worldwide for video games
Xiaomi		x	61.12 million phones sold in 2015
EU			
Criteo (FR)	x		37 countries, 4000 e-commerce companies
King (UK)	x		356 million average monthly unique users
Rocket Internet (D)	x		110 countries (Not US, China)
Shazam (UK)	x		100 million active users
Spotify (SW)	x		58 markets, 60 million active users
RoW			
Naspers		x	More than 130 countries

Source: compiled by author.

2.1.2 A marginal but relevant M&A growth model

We have only five companies which have opted to adopt an M&A growth model[42] (Google, Facebook, Flipkart, Naspers, and Rocket Internet) within diverse global reach

[40] As Spotify is aiming at the global market but was constrained by commercial negotiations for its deployment, for simplicity, it is included in the one step category.

[41] As explained in Box 1, metrics vary. The table gives what looks like the relevant metrics for the market where the company is operated.

[42] M&A strategy can be divided into three strategies: (1) vertical M&A; (2) horizontal M&A; and (3) diversification M&A. Vertical M&A refers to the acquisition of companies within the value chain and horizontal to the acquisition of competitors. Diversification M&A refers to the attempt to enter new markets. The author thanks Garry Gabison (IPTS) for this clarification.

strategies. Flipkart and Rocket Internet epitomize the two-step strategy with an M&A approach. This section discusses each of these five companies.

GAFA companies are very active investors (directly as companies or indirectly through their CEOs personal investments: see Section 2.2.2). They play a major role in the M&A market (see Table 7 for a summary of their recent investments and acquisitions). GAFA club companies have acquired or invested in highly notable starts-up: Amazon invested USD 112 million in Airbnb, Facebook bought Instagram (USD 1 billion in 2013) and WhatsApp (USD 19 billion[43] in 2014), and Google invested USD 258 million in Uber. This leads Davidoff-Salomon (2014) to state that "*the hunt by Google, Facebook and others for new businesses is also pushing up valuations"*. Amazon and Google appear less involved in an M&A (Table 7)

Table 7: GAFA Investments[44] and acquisitions from January 2012 to October 2014

	Investment and acquisitions (Billion USD)	Share of total US Internet deal activity
Amazon	2.2	2%
Apple	4.1	3%
Facebook	21.5	16%
Google	16	12%
Total GAFA	43.8	33%

Source: Fabernovel (2014: 47).

Google and Facebook have been included in this set of M&A companies because of their significant investments (both in relative and absolute terms). However, these companies have also been blending the organic growth model with mergers and acquisitions. They started with an organic growth strategy, much like Naspers. Google started acquiring companies three years after its foundation and Facebook has also started to widen the spread of its acquisition.

As of April 2015[45], Google had acquired over 180 companies. Android was acquired in 2005, YouTube in 2006, DoubleClick in 2007, and Motorola Mobile Business in 2011 (but sold to Lenovo in 2014). Google made a conscious effort to vertically integrate the software dimension of phones with that of the hardware.

GAFA companies initially followed an organic growth pattern. Similarly, BAT companies (Baidu, Alibaba, and Tencent), the Chinese equivalent of the GAFA, are now also growing through M&As: Alibaba invested in one of the taxi hailing app companies, Kuaidi Dache, and Tencent invested in another, Didi Dache[46]. Baidu acquired the Chinese mobile app store "91 Wireless" for USD 1.9 billion. Alibaba has made large investments in e-commerce and payments companies like Snapdeal and Paytm in India.

Rocket Internet is moving laterally (horizontal M&A): it is creating companies in new markets throughout the world (aside from the US and China). It has adopted what seems to be a holding company model, although the company claims to be a builder and not an investor. Its business model involves routinely launching new companies with a direct or indirect stake of 80% to 90%. The company identifies proven Internet business models and builds on them. It then transfers them to new, underserved or untapped markets where it seeks to scale them up until they become market-leading online companies. This might explain its expansion into Africa, the Middle-East and South America. The company

[43] The amount varies according to sources, Forbes (2014) gave 19 billion, and Bloomberg (2014) gave 22 billion.
[44] Direct or indirect (through subsidiaries) investments.
[45] *Source*: https://en.wikipedia.org/wiki/List_of_mergers_and_acquisitions_by_Google
[46] The two companies merged in 2015.

describes itself as a global network of companies (as of 2014, 114 were consolidated in the group financial statement), in which its participation varies (from 74.2% in Zencap to 21.4% in Jabong, see Figure 1 in the Rocket Internet case study, Part II of this report).

This model, which combines investment and industrial operation, is not new. It was used for instance in the 60s and 70s by the Lagardère Group (Hachette, Matra), and since the 90s by the Bolloré Group (Havas, Vivendi) in France. CK Hutchison Holdings Limited, formerly Hutchison Whampoa Limited, an investment holding company, is another example in the telecommunications sector, which has operations in 14 countries. The Hong Kong company runs under the name "3" - this is a financial model, rather than an industrial one. Companies like Rocket Internet that do not appear highly profitable can still earn money through sales of some of their portfolio companies.

Flipkart (founded in 2007) is an Indian online shopping destination for electronics, books, music and movies. It started off by selling books and music, and then expanded to personal gadgets and electronics. It followed the Amazon model[47] for product line diversification but not for the growth, as it has diversified through M&A. In 2010, Flipkart acquired WeRead, a social book discovery tool. In 2011, it acquired Mime360, a digital content platform company, and Chakpak.com, a Bollywood news site that offers updates, news, photos and videos. In 2014, it acquired Myntra, a leading online fashion retailer with innovative marketing and in 2015, a Bangalore-based global mobile network. In 2011, Flipkart entered the digital music market with Flyte, its digital music store, but this store has since been shut down.

Naspers adopted an organic growth model at first and then switched to an M&A growth model. Naspers (founded in 1915) started as a printer and publisher of newspapers and magazines, later adding book publishing to its operations. The business grew into one of Africa's leading media groups. In the 80s, this South African media conglomerate started to diversify out of the print domain, mostly into broadcasting. From 2000 on, it added the Internet operations. Initially it grew organically, but later it grew (with Internet operations) through its mergers and acquisitions. It is the world's third-largest player in e-commerce, after Alibaba and Amazon, and operates predominantly in markets with high growth potential. These include Africa, China, Latin America, Central and Eastern Europe, Russia, India, South-east Asia and the Middle East. Most of the company businesses are market leaders in their sectors. Naspers invested in Tencent as early as 2001. In 2006, the company invested in the Russian internet business, Port.ru, Inc. (mail.ru). Now it is also investing in India: Flipkart (2012), redBus.com (2013), India's biggest bus ticket portal. Naspers' subsidiary, Allegro, is duplicating its parent's approach in Eastern Europe. Allegro controls more than 50% of e-commerce traffic in Poland and is a leading player in Eastern Europe, with operations in Czech Republic, Slovakia, Hungary, Bulgaria, Romania, Ukraine, Latvia, Lithuania, Estonia, Russia, Belarus, Kazakhstan and Serbia.

2.2. The role of the business environment

Unicorns reportedly rely on venture capital for their initial funding. Thus, the first part of the following section analyses the role of venture capital in the setting up and development of unicorns. The following section closes with a comparison of the US and EU financial systems. Then, Section 2.2.2 describes the background of the unicorns' "founding fathers".

2.2.1 A strong access to finance

The important role of venture capital (VC)

Start-ups usually get their seed funding as convertible debt from angel investors[48], with terms that essentially set a price on the company (Shontell, 2013). When these seed

[47] Founders came from Amazon India, see Section 2.3

[48] An investor who provides financial backing for small startups or entrepreneurs. Angel investors are usually found among an entrepreneur's family and friends. The capital they provide can be a

companies grow, they require more funds. Venture capital (VC) firms raise funds from their own investors and purchase equity stakes in high-risk, high-growth-potential firms (Veron, 2012: 25) in the early stages (seed, start-up and expansion stage). VC is a form of private equity investment and the other is usually buyout investing[49] (Ritter, 2014:2).

Table 8 shows the investors in each of the unicorns of our sample. Most of these investors were US VC companies. Other major investors included Naspers (South Africa) and the Japanese group Softbank (funding Alibaba, Zynga, and Criteo).

US VC companies also invested in EU firms: Bessemer Ventures (Criteo), Apax (King), KPCB (Shazam), Technology Crossover Ventures (Spotify). The only notable exception not to receive funds from US VCs was Rocket Internet (Germany): instead, it received funds from a much higher number of EU investors (from Nordic countries).

UK and French VCs invested in Criteo (Idinvest - see Box 5, and Elaia, two French VCs), in King and Shazam (Acacia Capital and DN Capital, both London based).

In Asia, investors are mostly regional, specialised companies like Singapore's Temasek (see Box 7) or the US company based in Beijing, IDG. Some leading US VC firms, like Sequoia or Accel, also lead in Asia (see Table 15 Top ten investors in Asia, Appendix 1).

Table 8: List of main investors in unicorns (2014)

Company	Investors
US	
Akamai	NA. Went public in 1999, first year of operation.
Amazon	Kleiner Perkins Caufield & Byers
Apple	NA
Airbnb	Sequoia Capital, Grayloc and Partners General Catalyst Partners, SV Angel, Andreessen Horowitz
Cloudera	Caterina Fake, Youssri Helmy, Diane Greene, Qi Lu, Accel Partners, Jeff Weiner, MSD Capital, Google Ventures, T. Rowe Price, Ignition Partners, Greylock Partners, Meritech Capital Partners, In-Q-Tel.
Facebook	Peter Thiel, Reid Hoffman, DST Global, Goldman Sachs, Elevation Partners, TriplePoint Capital, Li Ka-shing, Horizons Ventures, Stuart Peterson, European Founders Fund, Microsoft, Meritech Capital Partners, Greylock Partners, Mark Pincus, Accel Partners, SV Angel.
Google	Andy Bechtolsheim, Sequoia Capital, Kleiner Perkins Caufield & Byers
Uber	First Round Capital, Chris Sacca, Bill Gurley, Goldman Sachs, Menlo Ventures, Bezos Expeditions, Google Ventures, BCCL (the Times of India group), Microsoft, Hillhouse Capital, Baidu, China CITIC Bank, China Life Insurance and Ping An Insurance Group.
Twitter	Lowercase Capital, Union Square Ventures, Bezos Expeditions Jason Port, Greg Yantanes, Brian Pokomy, S.Anderson. Morgan Stanley, Kleiner, Perkins, Andreessen Horowitz
Zynga	Kleiner Perkins Caufield & Byers, Fidelity Investments, T. Rowe Price, Morgan Stanley, Google, SoftBank Capital, DST Global, Tiger Global Management, Institutional Venture Partners (IVP), Andreessen Horowitz, Kevin Rose, Foundry Group, Union Square Ventures, Avalon Ventures, SV Angel, Pilot Group, Peter Thiel, Reid Hoffman.

one-time injection of seed money or ongoing support to carry the company through difficult times. *Source*: Investopedia: http://www.investopedia.com/terms/a/angelinvestor.asp#ixzz3nEY1Ud8 1

[49] The purchase of a company's shares in which the acquiring party gains controlling interest of the targeted firm. Incorporating a buyout strategy is a common technique used to gain access to new markets and is one of the most common methods for inorganically growing a business. *Source*: Investopedia http://www.investopedia.com/terms/b/buyout.asp#ixzz3nEWGPnhl

Company	Investors
Asia & ROW	
Alibaba	Kleiner Perkins Caufield & Byers, GGV Capital, Sequoia Capital China, Softbank, Yahoo (10%), Temasek.
Baidu	Bridger Management, China Equity, China Value, Draper Fisher Jurvetson, Google, Greg Penner, IDG Capital Partners, Integrity Partners, Peninsula Capital Fund, Providence Equity Partners, Scott Walchek, Venture TDF
Flipkart	Naspers (through MIH India), Accel Partners, Iconiq Capital Llc Tiger Global DST Global, Qatar Investment Authority, GIC. Intervision Holdings, IDG Ventures, Sofina, Vulcan Capital, Erasmic Ventures, Helion Ventures and several funds of Morgan Stanley and Fidelity.
Garena	Tencent, Ontario Teachers' Pension Plan
KakaoTalk	Korea Investment Partners, DCM, CyberAgent Ventures, Maverick Capital, Tencent Berjaya
Naspers	NA
Tencent	Naspers, International Data Group Inc., PCCW
Xiaomi	Temasek, IDG Capital, Qiming Venture Partners, GGV Capital partner Qualcomm, Yuri Milner (DST), Morningside Ventures
EU	
Criteo	Index Ventures, Idinvest Partners, Elaia Partners, Bessemer Venture Partners, Softbank.
King.com	Apax, Index Ventures[50], Klaus Himmels
Rocket Internet	Emesco AB (Sweden), Companies Registration Office (SCRO), United Internet Ventures AG (Germany); PLDT Online Investments PTE. LTD (Singapore), and European Holdings (Luxembourg).
Shazam	Kleiner Perkins Caufield & Byers, Institutional Venture Partners, DN Capital, Acacia Capital Partners, America Movil
Spotify	Sean Parker, Technology Crossover Ventures, Universal Music Group, Sony Music

Source: Crunchbase, compiled by the author, see Appendix 1 for more information.

VC funds typically earn a carry of 20-30% of the upside[51] in a fund's performance. Besides this performance fee, VCs also get paid a management fee, often 2-3% of the total funds raised paid annually, according to Tantry (2015). As this fee is paid regardless of performance, it incentivizes fund managers, according to Tantry[52], to keep financing companies that have little to no future because they can diversify their investment: one successful investment in a start-up can carry an entire fund.

In general, VC funds thrive because they make large returns on a few companies. Some US VCs have become known as the "usual suspects from the road to Menlo Park" (see Table 13, Appendix 1) because they tend to invest in the most successful deals and they are located near Menlo Park (Palo Alto) (Ezratty, 2014). These VCs include: Accel Partners, Andreessen & Horowitz, Benchmark Capital, Kleiner Perkins Caulfield & Byers, Sequoia Capital. They financed the companies in our sample and some of them have done so since the very start as VC or angel investors (Peter Thiel in Facebook and Zynga).

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[50] A Swiss, Geneva based VC.

[51] Upside capture ratios for funds are calculated by taking the fund's monthly return during months when the benchmark had a positive return and dividing it by the benchmark return during that same month.

[52] Tantry argues that the 10 year lifecycle of a fund as compared to the 2-4 year fundraising cycle incentivize fund managers to keep investing in these no-future companies in keep a simile of positive returns. Venture capital funds have, however, in places mechanism that restrain these occurrences.

GAFA companies are very active investors and play a major role as investors start-ups. For example, Google invested in Baidu, Cloudera and Uber[53], and Amazon in Airbnb and Twitter. Naspers is a major investor in four companies in our sample (Tencent, Allegro, Ricardo, and Flipkart (through MIH India). When companies reach the size of Alibaba or Tencent, they are more likely to become investors than receive investments: Tencent in Kakao Talk, and Garena. Alibaba and Xiaomi are investing in a growing number of start-ups, thus extending their ecosystems.

Some VCs have recorded more hits than others. For instance, Kleiner Perkins Caufield & Byers (see Box 6) financed six unicorns in our sample (Google, Alibaba, Zynga, Shazam, Amazon). Others invested in three of our unicorns - for example, Andreessen Horowitz (Twitter, Airbnb, Zynga), IDG Ventures (Flipkart, Xiaomi, Baidu), SV Angel (Facebook, Airbnb, Zynga) Morgan Stanley (Flipkart, Twiter, Zynga) or Sequoia Capital (Google, Alibaba, Airbnb).

Several unicorns have been financed by numerous major investors, in particular Uber (financed by Baidu, Bezos expeditions, Goldman Sachs, Google, Microsoft), Facebook (Accel partners, Goldman Sachs, Microsoft, Peter Thiel, SV Angel), Zynga (Andersen Horowitz, Google, Kleiner Perkins Caufield & Byers, Morgan Stanley, Peter Thiel, SV Angel) or Airbnb (Amazon, Andersen Horowitz, Sequoia Capital, SV Angel)

While the data covers only our small sample of unicorns, it offers some strong indications about the existence of a dense VC ecosystem supporting the unicorn phenomena.

In the EU, the UK has the most venture capital available (Simon, 2013), followed by France. This (relative) strength may account for the presence of companies from the UK (Shazam) and France (Criteo, Blabla cars) in this sample, and also in the Atomico report. It may be difficult to state that the absence of unicorns from other countries like Italy or Spain is directly linked to their weaker VC sector, but it could have had an impact.

Box 5: Idinvest Partners. A European leader in private equity investing in unicorns

Idinvest Partners is a pan-European private equity manager which targets the low and middle market segment. This company manages EUR 5 billion and its headquarters are in Paris. Every year, this company invests around EUR 250 million in seed, early stage ventures, and later stage ventures.

The company has developed several complementary areas of expertise:

- Equity investments in buyout deals targeting both medium-sized and also young innovative European companies.
- Primary investments in European Private Equity funds targeting primarily the middle market segment.
- Secondary investments (acquisition of positions in Private Equity funds).
- Mezzanine investments in Europe (direct investments, secondary, primary).
- Private equity consulting (discretionary/non-discretionary investment services).

The company operated as AGF Private Equity, a former department of Allianz, and has become a leading private equity player in Europe. The company became independent in 2010. The company invested in Criteo, Dailymotion, Deezer, and Meetic.

Source: http://www.idinvest.com/en/who-are-we.php, https://www.crunchbase.com/organization/idinvest-partners#sthash.0qYf7QeG.dpuf

The extent to which the companies in the sample rely on VC funds varies. Some receive large funds, which attract news coverage whereas others collect more modest amount and rely instead on self-funding: for example, Baidu, which has only received USD 161.2 million since its inception in 2000.

[53] Microsoft invested in Uber in July 2015. The company has investments in Facebook.

The amount of money needed is linked to the strategy adopted. Some companies like Uber or Rocket Internet have aggressive commercial strategies and use the funds collected for buying markets shares in new tech markets where it is expected that first mover advantage will generate a "winner takes all"" result (see Box 6).

Filloux, looking at the examples of Airbnb and Uber, notes: "*Since there is very little technology involved, where did the money go? Mostly to market share acquisitions, the only way to leave the competition in the dust for good*" (Filloux, 2014). The race for funds for the private car-hailing Chinese market is a fierce head-to-head competition. In 2015, Didi Kuaidi[54] claimed to have a war chest filled with over USD 4 billion. Uber had secured USD 1.2 billion for its China business, backed by companies like Baidu (Coghlan, 2015), whose Chinese operations are valued at USD 7 billion (Waring, 2015c).

Box 6: First mover advantage: overrated?

New tech markets are often dominated by one company, called the "category king" by Ramadan et al (2014). Uber is the 'category king' for demand transportation, "*Airbnb is doing that in on-demand rentals. Salesforce.com did it in cloud-based CRM. Of the 80 or so USD 1 billion companies founded since 2000, half are Category Kings. They are more valuable than all the other companies in their categories combined. These firms routinely take more than 70% of the total available market cap of their market*".

In China, Didi-Dache and Kuaidi Dache, the soon-to-merge taxi-hailing apps[55] will control 99% of the Chinese market for these apps. Didi Kuaidi, is the world's largest smartphone-based taxi service. At the same time, overfunding a player in a particular category can be perceived as a way to crowd out competition.

One may wonder to what extent the claim that first mover advantage ensures the winner takes all is grounded. Or, as suggested by T. Lee (2015) giving the examples of winner-loses-all, are "*First-mover advantages overrated*"? He pointed out that though Microsoft, had been involved in the cloud, the internet of things, and smartwatches since the early-2000s, "*Google dominates cloud, the internet of things is still nascent, and Apple is the frontrunner in the wearables race*". The same can be said about Nokia and smartphones or video games on mobile phones.

The question is still open, especially for such fast changing high tech markets where first-movers can disappear as quickly as they appear[56].

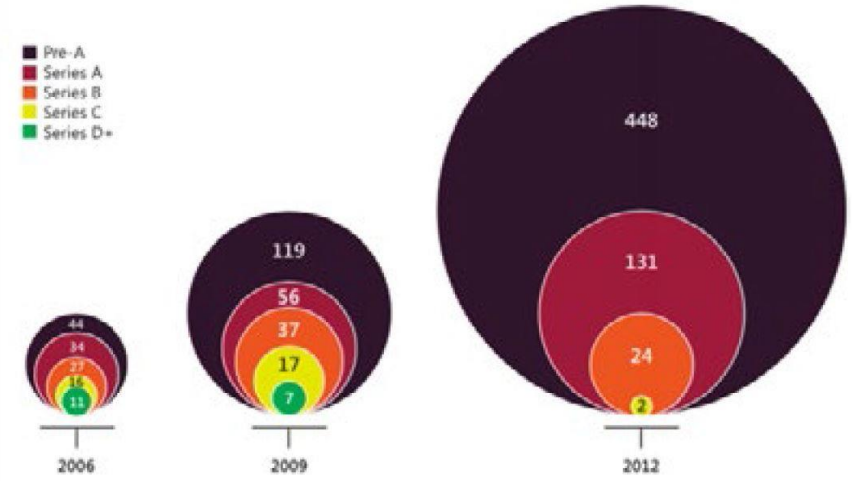
In recent years, both the size of the funds collected by start-ups and the pace at which this happens (timeline of time to market cap) has dramatically increased. Figure 2, illustrates that trend between 2006 and 2012 for Silicon Valley-based start-ups.

[54] The Chinese unicorn partnered with Uber's main US competitor, Lyft, another unicorn.

[55] The company continues to run separate apps but has combined their technology and data. It raised USD 2 billion in July, valuing it at an estimated USD 15 billion (Waring, 2015).

[56] Since the start of this study, the number of unicorns identified is such listings as Atomico has doubled, with newcomers. Competition is harsh and not all end up winners.

Figure 2: Investment in Silicon Valley-based start-ups in 2006, 2009, and 2012 (million USD)



Source: CB Insights/ Collaborative Economics, quoted by Global start up ecosystem ranking (Compass, 2015:13).

Even when they go public through an IPO, most companies remain secretive as to how they use the funds collected.[57]

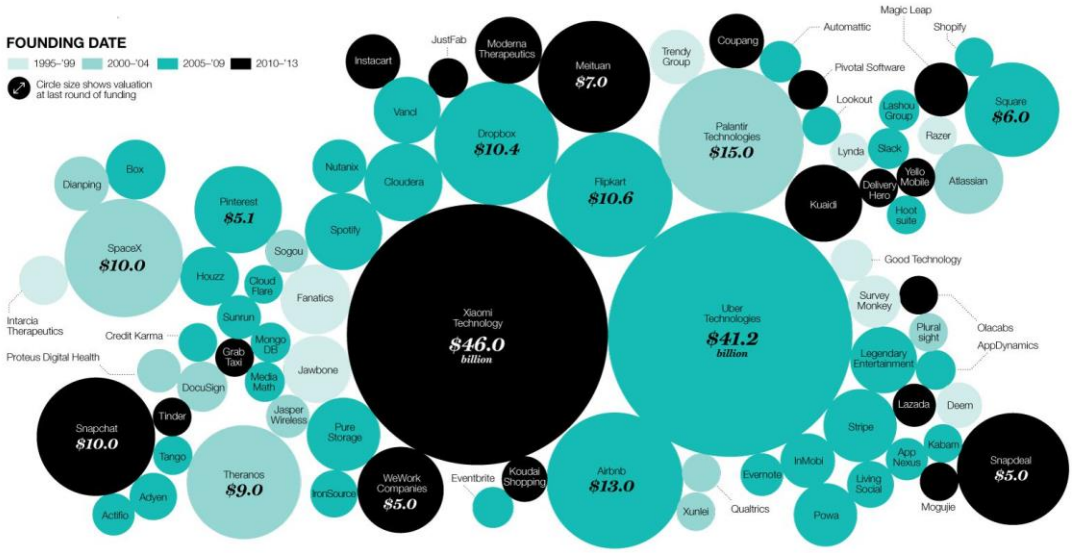
In general, these companies use the funds for growth – in whatever growth approach they embraced, as discussed above. Many companies specify in their annual reports that they will not distribute any dividends, and that they will keep their earnings for use in the operation of the business, to finance future growth, for example Akamai, Alibaba, Amazon, Baidu, Facebook, and Google. Only Apple and Naspers are distributing returns to shareholders.

Figure 3 shows the most recent valuations (during 2015) according to the year of creation. The size of the circles shows the market capital valuation according to the last round of investment. The colour of the circle shows the year of creation: the darker the circle, the younger the company. Younger companies tend to have higher valuations: companies funded after 2006 (dark green and black circles) are much bigger than the earlier ones (lighter shades of green). Amazon (USD 8 million) and Google (USD 25 million between its foundation in 1998 and its IPO in 2004) have been much more modest when raising funds earlier. Newcomers are sometimes described, because of their potential to rapidly reach a USD 10 billion valuation, as "decacorns."(Griffith and Primack, 2015, A. Lee 2013).

Ramadan et al (2014) note than "*At USD 41 billion, Uber has become more valuable more quickly than any other start-up we've seen in recent years — faster than Facebook, Google, Amazon.com, and Salesforce.com*". It took more than 15 years for Amazon and Google, and still 10-11 years for Facebook to reach their current valuations.

[57] We found only one company in our sample that attempted to disclose this information but remains vague: Akamai stated shortly after its 1999 IPO that it "anticipates using net proceeds from the offering for working capital and general corporate purposes."

Figure 3: Mapping the highest valuations of start-ups



Source: *Fortune* : http://fortune.com/2015/01/22/the-age-of-unicorns/

The EU/US gap

VCs have raised more funds in the US than they have in the EU. In 2014, according to an AFME/BCG report (Afme, 2015: 27), EUR 488 billion of private equity were ready to be invested in the US, whereas in the EU, only about half the amount – i.e. EUR 245 billion (about half the amount) - was available. The level of VC and angel investments is significantly higher in the US than in Europe: in the US, EUR 26 billion is invested annually by VC firms and EUR 20 billion by Angel investors, while in Europe these amounts are EUR 5 billion and EUR 6 billion respectively (Afme, 2015: 27); an even lower ratio (almost 1 to 5). Historically, the US benefits from an early mover advantage because modern venture capital was born there in 1946, arriving in Europe later - around the 80s (Veron 2012: 26).

Veron (2012: 30) contrasted the US "*thick markets*, *characterised by high levels of interaction between venture capital funds and firms*", and the thinner EU "*markets defined by a limited number of investors and firms within the economy that have difficulties in finding and contracting with each other at reasonable costs*".

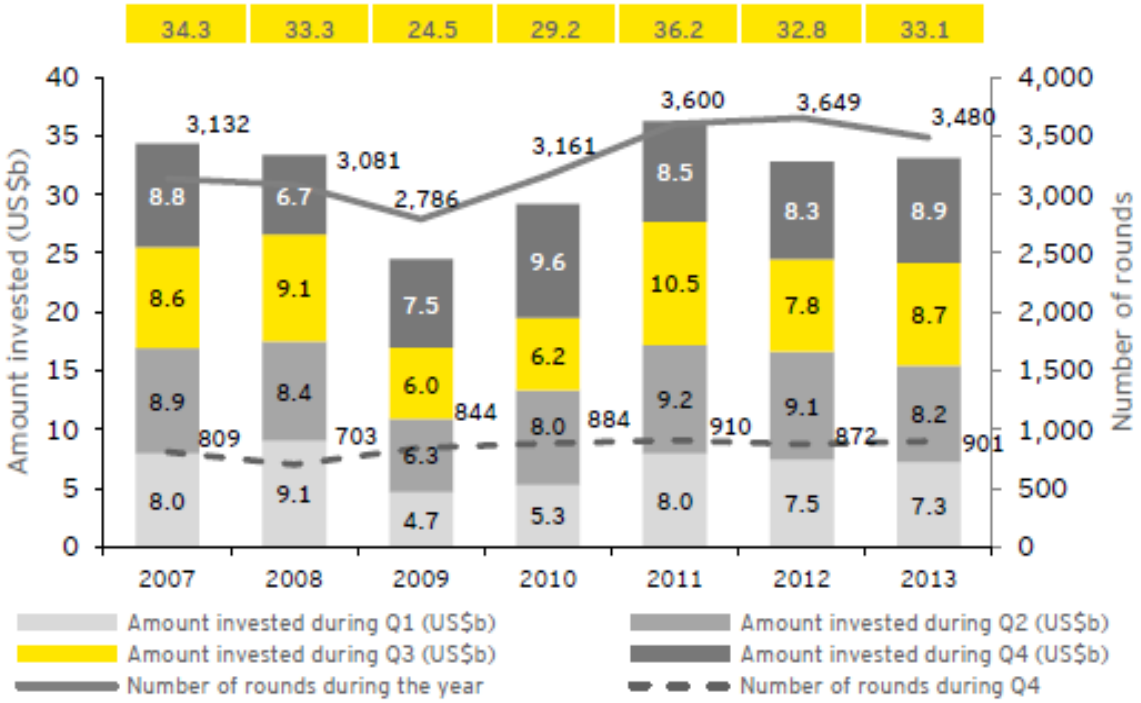
EY (2014: 11) notes that Europe attracts "*small-ticket deals*". Figure 4 shows that the level of VC investments in the US, between 2007 and 2013, hovers at around USD 30 billion (this fell in 2009 with the crisis). Figure 5 shows that it fluctuated at around USD 7 billion in Europe[58] during the same period. The global level of investment per year fluctuated around USD 50 billion, falling to USD 35 billion in 2009 (EY 2014: 8). Investments from the top 10 US investors between February 2013 and 2014 (see Appendix 1, EY 2014: 39) added up to USD 14.47 billion – three times the amount that Afme claims is invested by EU VC funds.

In 2015, venture capital soared to record heights. The venture capital ecosystem deployed USD 58.8 billion across the United States in 2015, marking the second highest full year total in the last 20 years (Moneytree report, 2016 quoted by Marketwired). CB Insights (2016: 40) indicates an even higher number: USD 74.2 billion across 4,890 deals. CB Insights (2016: 31) points out that there is a correlation between this global record high and the number of unicorns: "*The peak of these investments promoted 72*

[58] EY gives Europe and not the EU.

VC-backed companies to achieve Unicorn status …during the course of 2015. By comparison, 53 companies reached Unicorn status in the year previous".

Figure 4: VC investment in the US (2007-2013)

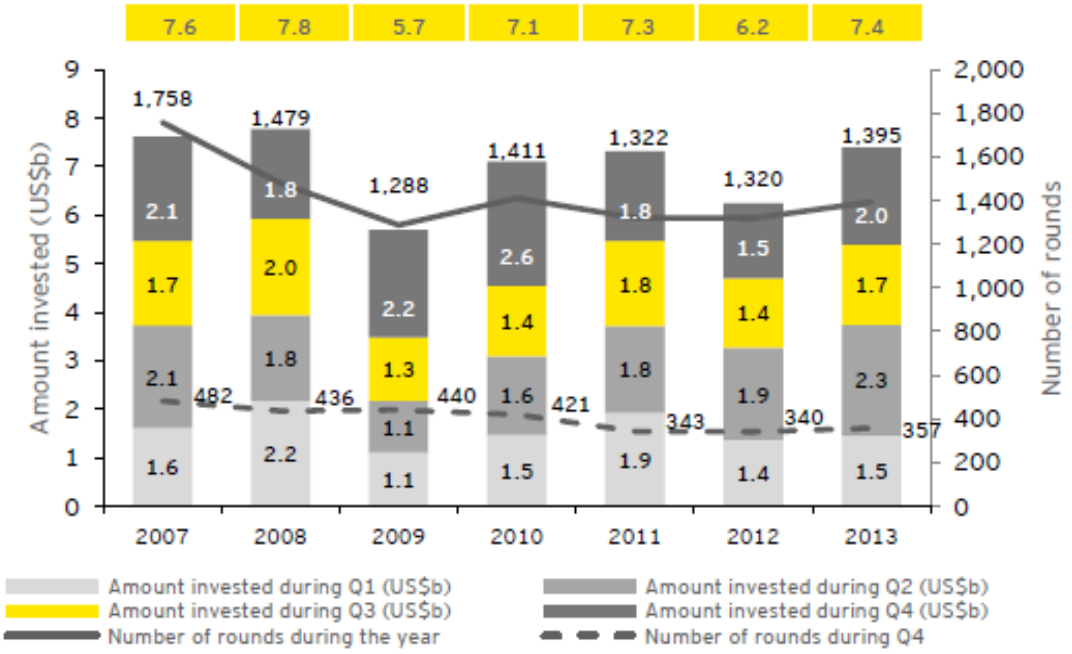


Source: EY (2014: 9)

The amount of funds available in Europe has increased over the last decade. Equity financing for European VC-backed companies reached EUR 7.9 billion, up from EUR 6.3 billion in 2013. Bollen adds that the number of venture-backed IPOs[59] in the region more than tripled to 55 and these VC-backed IPOs raised a total of EUR 3.7 billion. In 2013, 18 IPOs raised a total of EUR 500 million. The online platform Rocket Internet was Europe's largest venture-backed IPO in 2014, raising EUR 1.4 billion on the Frankfurt Stock Exchange. CB Insights (2016: 64) reveals a similar all-time high for the EU in 2015, as VC-backed companies in Europe raised USD 13.4 billion in funding across 1,387 deals.

[59] On IPO one of the best source of historical information is Jay Ritter's website: http://site.warrington.ufl.edu/ritter/ipo-data/

Figure 5: VC investment in Europe (2007-2013)



Source: EY (2014: 9)

US VC funds are active investors. For instance, VC Kleiner Perkins Caufield & Byers (see Box 6) have been investing in a wide range of leading IT companies: Amazon, AOL, Electronic Art (EA), Google, Spotify, JD Com (China), Uber, Zynga, Twitter, Waze.[60] Together with IT companies and other industrial players, they have built a favourable environment for start-ups, as illustrated by the creation of the sFund (see Box 4) launched by KPCB with Amazon, Facebook, Comcast[61] and Liberty Media.

Box 6: A VC from Menlo Park investing in unicorns: Kleiner Perkins Caufield & Byers (KPCB)

Kleiner Perkins Caufield & Byers, founded in 1972, is a venture capital firm specializing in investments in incubation, seed stage, early stage, growth capital, expansion capital, and later stage companies. It is considered to be one of the most established firms in the sector (Wall Street Journal, 2010).

On its website, the company introduces itself as "*a venture capital firm with over 40 years of experience helping entrepreneurs deliver world changing ideas to market*." KPCB partners with entrepreneurs to turn ideas into world-changing businesses. The firm has helped build pioneering companies like Amazon, Electronic Arts, Genentech, Google, Nest, Netscape, and Twitter. KPCB portfolio companies employ more than 250,000 people. More than 150 of the firm's portfolio of companies have gone public. The company was ranked n°1 of the most active VC firms in 2014 by a MoneyTree Report and by the EY report (see Appendix 1). In 2015, assets under its management reached USD 6,833 million.

On its website, KPCB states that it "*offers entrepreneurs years of operating experience, puts them at the center of a vast and influential network, and accelerates their success through expertise and support in recruiting, product design and delivery, business development, strategic partnerships and brand building*". KPCB provides services to their companies which form a peer community.

[60] http://www.kpcb.com/companies, last consulted April 2015.
[61] N°1 global media company according to the Forbes 2014 Global 2000 List.

KPCB's China investment advisory team was founded in 2007 to build up a dialogue between outstanding entrepreneurs and investors in China. It has offices in Beijing and Shanghai, and has invested in Alibaba, Baidu[62] and JD Com among others.

In October 2010, KPCB launched a new USD 250 million fund called sFund to fund start-ups in the social space with Facebook, Zynga and Amazon, Comcast, Liberty Media and Allen & Company, LLC as co-investors.

Source: www.kpcb.com, http://blogs.wsj.com/venturecapital/2010/01/22/one-of-these-venture-capital-firms-is-not-like-the-other/ , http://techcrunch.com/2010/10/21/the-kleiner-perkins-sfund-a-250-million-bet-that-social-is-just-getting-started/, https://tech.co/top-vc-firms-to-pitch-your-startup-to-2015-02 , http://www.entrepreneur.com/article/242702

Filloux claims Silicon Valley's strength is its pool of accessible capital. He thinks that what is possible in the US is still not possible in the EU (Filloux, 2014). Taking a closer look at the French case, Filloux emphasizes that the size of the French venture capital ecosystem remains problematic: the French VC system is 50 times smaller than the US one, though France's GDP is only 6 times smaller (Filloux, 2015a). France ranks among the larger EU VC ecosystems.

VC investment in Asia has also become more substantial (see Box 7). VC companies are backing Asian start-ups more and more, especially in China and India. In China, the VC investment level went from USD 3.9 billion in 2007 to USD 3.5 billion in 2013 – but it had peaked at USD 6.5 billion in 2011 (EY 2014: 9). It went up again in 2014 to another peak of USD 11.2 billion (T. Lee, 2016). T. Lee (2016) notes the striking amount of VC funding in China, where there was more VC funding in 2015 than in all the other Asian countries[63] combined: USD 41.8 billion out of USD 55.3 billion for Asia[64]. T. Lee stresses that *"It's the only nation capable of standing toe-to-toe with the US"*. He highlights that the amount invested in Didi alone (USD 3 billion) is higher than the total amount invested in Singapore, Japan and Israel. In India, VC investment went from USD 0.9 billion in 2007 to USD 1.8 billion in 2013 (EY 2014: 10), and up to USD 7.9 billion in 2015 (T. Lee, 2016).

Box 7: Temasek, a VC from Singapore which invests in unicorns

Temasek is an investment company based in Singapore. Supported by 11 offices globally, Temasek owns a portfolio worth SGD 266 billion as of 31 March 2015, mainly in Singapore and Asia. Temasek was incorporated under the Singapore Companies Act in 1974 to hold and manage investments and assets previously held by the Singapore Government. These were investments made in the first decade of nation building after independence in 1965. The objective of the transfer of these assets to a commercial company was to allow the Ministry of Finance to focus on its core role of policymaking and regulations, while Temasek would own and manage these investments on a commercial basis. The initial portfolio of SGD 354 million comprised shares in companies, start-ups and joint ventures previously held by the Singapore Government. They included a bird park, a hotel, a shoe maker, a detergent producer, naval yards converted into a ship repair business, a start-up airline, and an iron and steel mill.

Temasek's investment themes centre on: transforming economies; growing middle income populations; deepening comparative advantages; and emerging champions. Its portfolio covers a broad spectrum of industries: financial services; telecommunications, media and technology; transportation and industrials; life sciences, consumer and real estate; as well as energy and resources.

[62] Not found in Crunchbase, not listed in Table 5 and Appendix 1.
[63] India: USD 7.9 billion, South Korea: USD 1.19 billion, Singapore: USD 970 million, Japan: USD 569 million, and Taiwan: USD 440 million.
[64] E-commerce dominates with USD 15.9 billion.

Total shareholder return for Temasek since its inception in 1974 was 16% compounded annually. Temasek has had an overall corporate credit rating of "Aaa" by Moody's and "AAA" by Standard & Poor since its inaugural rating in 2004. Temasek caught the winds of change in Asia, as its economies recovered from the depths of the 1997 Asian Financial Crisis. Targeting Asia, the investment company seeks to deliver sustainable returns over the long term through its four investment themes. Consequently, its Asia exposure outside Singapore grew almost six times over the decade, while exposure outside Asia more than doubled.

Temasek invested in Alibaba, and Xiaomi directly. It also invested in Rocket Internet's Indian subsidiary, Lazada, a premier online mall, acting as a co-investor with Rocket Internet.

Source: http://www.temasek.com.sg/abouttemasek/corporateprofile

Some of the leading US VCs have opened offices in China. GGV Capital partner, Jenny Lee (see Box 8), is often quoted as one of the most respected investors in the Chinese tech scene, having helped GGV get into Xiaomi, mobile games maker Yodo1, Chukong Technologies and social platform YY (Konrad, 2015). The Asian companies in our sample (Table 5) have benefited from US companies coming to the region. US VC firms' strength lies in working together on deals.

Box 8: Bridging regions: GGV Capital investing in unicorns

GGV Capital, a venture capital firm focused on multi-stage investments in the US and China, operates as a single team across the US and China, working with entrepreneurs to build category-leading companies. The investment firm explains that, having recognised in 2000 that the world's two largest economies, US and China, were becoming increasingly intertwined, it decided to back this trend. The long-term focus on these two markets, as well as established local presence, gives the company a unique ability to help entrepreneurs within and across these two markets. It seeks to partner with entrepreneurs and CEOs to create category leaders.

GGV Capital leads early and late-stage rounds of financing of USD 5-25 million and backs teams that are starting to scale up and are looking for growth. With a total capital across six funds of USD 2.7 billion, the company has been through 18 IPOs and 11 acquisitions since 2010. GGV Capital invested in Alibaba, Grab Taxi, Kingsoft, Pandora Radio, Yodo1, and YY.co.

Just like Temasek, GGV stresses that their China consumer investments focus specifically on opportunities in China that stem from the fast growing middle class, the rise in disposable income and the government's commitment to urbanization.

Source: http://www.ggvc.com/about-ggv

The stronger relationship (see Box 8) between China and the US may not really improve the position of the EU or the access to funds for EU tech start-ups. The scale of the funds involved in Asia and the US, as we have just noted, is staggering.

Table 9 (Exits[65] of the unicorns) shows the year and amount collected on company exits in our sample. 11 out of the 23 selected unicorns went public. The remaining 12 are still private companies. The amounts raised vary hugely from the modest USD 54-55 million

[65] The method by which venture capitalists or business owners get out of an investment that they has made in the past. In other words, the exit strategy is a way of "cashing out" an investment. Examples include an initial public offering (IPO) or being bought out by a larger player in the industry. Also referred to as a "harvest strategy" or "liquidity event". *Source*: Investopedia http://www.investopedia.com/terms/e/exitstrategy.asp#ixzz3nEaIkrjG

collected by Amazon in 1997 to the skyrocketing USD 25 billion raised by Alibaba in 2014, the world's largest-ever IPO.

In general, the amounts raised in the initial IPO exits [66] have increased over the years for the sampled companies. When Akamai went public in 1999, it collected USD 1.3 billion; it was, then, the fourth-largest first-day increase.[67] Rocket Internet raised EUR 1.4 billion, the largest EU IPO in 2014.

Table 9: Exits of the unicorns

Company	**Year**	**Amount** (million)
US		
Amazon	1997	USD 54-55
Akamai	1999	USD 1300
Google	2004	USD 1670
Facebook	2012	USD 16000
Twitter	2013	USD 1820
Asia		
Tencent	2004	USD 199
Baidu	2005	USD 109
Alibaba	2014	USD 25000
EU		
Criteo	2013	EUR 250-300
King.com	2014	USD 500
Rocket Internet	2014	EUR 1400

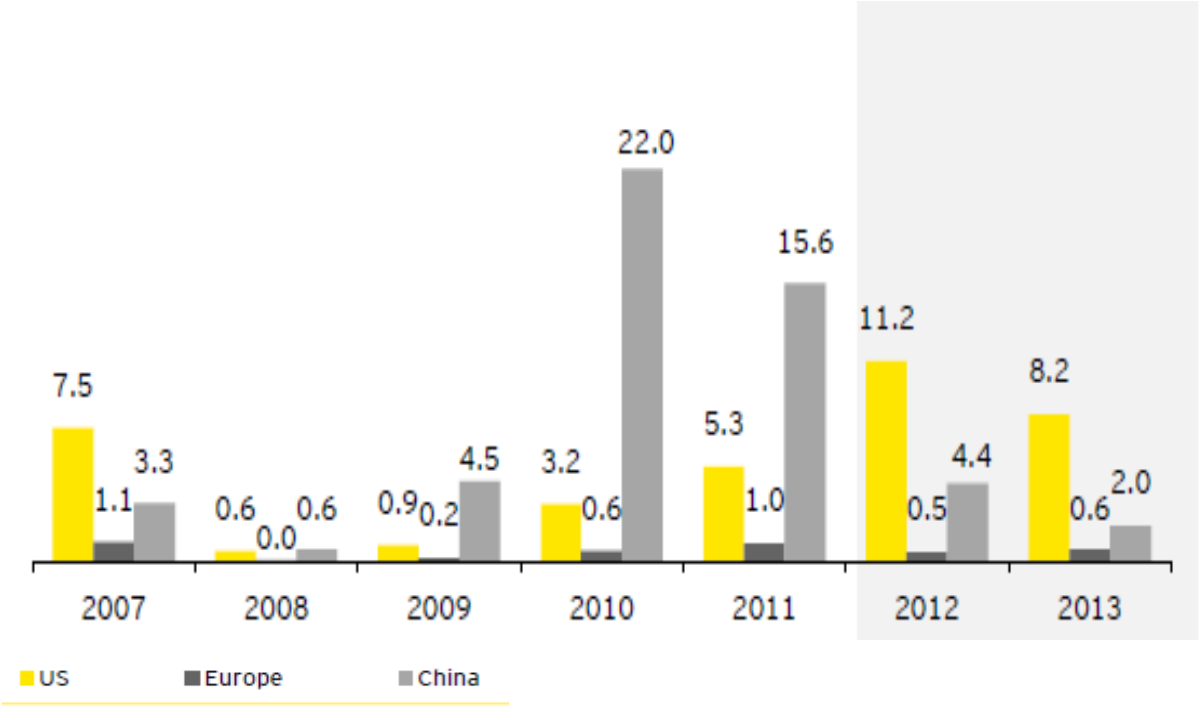
Source: compiled by author.

To put Table 9 into a broader perspective, Figure 6 shows the amount collected through global VC-backed IPOs (2014). The US and China were the most active markets for VC-backed IPOs in 2013, though their scores were significantly lower than they were in 2010. EY (2014: 32) notes that biopharmaceuticals and the consumer information service sectors drove IPO activity, both in value and volume, in both countries. Figure 6 also shows that even though the number of VC-backed IPOs in Europe has tripled, it is still very modest or low compared to the US (below the 1 billion threshold most of the time).

[66] An initial public offering (IPO) is the process through which a company makes the transition from a privately held entity to a public company with stock traded on one of the major stock exchanges. Typically, a company going through an IPO is young and relatively unknown, therefore IPOs generally are considered riskier investments. However, established private companies occasionally decide to "go public" in order to raise more capital. *Source*: http://www.pbs.org/wgbh/pages/frontline/shows/dotcon/thinking/primer.html

[67] Or first day pops. The "pop," also referred to as the first-day price spike, is the price differential between the offering price of an IPO stock and its closing price on the first day of trading. *Source*: http://www.pbs.org/wgbh/pages/frontline/shows/dotcon/thinking/primer.html

Figure 6: Global VC-based IPOs (2014): amounts[68] raised through IPO exits (USD billion)



Source: EY (2014: 32).

Beyond raising funds, Filloux considers that the main issue for most of Europe (but not the UK) is the exit for successful companies: European stock markets cannot compete with the Nasdaq (Filloux, 2015a). According to a study by France Digital, he quotes, "*9 out 10 start-up companies financed by VCs are sold to foreign acquirers (US and Asia)*." He takes two recent French examples: BlaBlaCar raised USD 100 million entirely from foreign funds; and Sigfox[69] raised EUR 100 million mostly form foreign funds and from state-owned Banque Publique d'Investissement. Filloux (2014) does not hesitate to state, analysing the disruptive models brought by this kind of companies, that "*In these new models, the American venture capital ecosystem is acting as a weapon of mass domination*". If this statement is true, it is certainly not good news for the EU innovation system.

2.2.2 A dense ecosystem of founding fathers (and mothers?)[70]

Start-up entrepreneurs often introduce themselves as "serial entrepreneurs". Through their experience and their university backgrounds, they have built over time networks they can use for their new endeavours.

Table 10 lists and describes some of the backgrounds of the founders of our 23 unicorns.

The number of serial entrepreneurs is significant in our sample: 24 of 63 listed founders have created other companies before. The average entrepreneur in our sample is a seasoned businessman with a strong academic background from a top university (e.g. Cornell, Harvard, MIT, Stanford, Yale in the US or similar in the EU e.g. Ecole des Mines). Among her US 2013 sample, Lee notes that within these selective universities: "*Stanford leads the roster with an impressive one-third of the companies having at least one Stanford grad as a co-founder. Former Harvard students are co-founders in eight of 38 unicorns; Berkeley in five; and MIT grads in four of the 38 companies*". Our sample also

[68] Proceeds only include new shareholders.
[69] A company specialized in Internet of Things connectivity.
[70] None! A. Lee (2015) notes that there were no female CEOs on her 2013 Unicorn list, and only 3 in 2015, adding a nice understatement: "*There's still too little diversity at the top in 2015*".

includes 7 entrepreneurs from Stanford. This highlights the role played by the Silicon Valley cluster.

This supports what Lee (2015) wrote in her 2015 edition of the Unicorn list: "*Take heart, "old people" of Silicon Valley: Companies with educated, tech-savvy, experienced 30-something, co-founding teams with history together have built the most successes." She further notes: "…76% of companies have founders with entrepreneurial history and a track record of founding something else previously".* She stresses the role of education: "*Education seems kind of important. About half our list have extremely well-educated co-founders, who are graduates of a "top 10" U.S. school*".

However, she also finds that "*19% also have a co-founder who dropped out of college*". There are some of these outliers in our sample: Facebook's founder, Mark Zuckerberg is a college drop-out; the founder of Uber, Travis Kalanick, also dropped out of the University of California, Los Angeles; and Jack Yun Ma, the founder of Alibaba, was an English teacher. And of course, Steve Jobs.

Table 10: Serial entrepreneurs, seasoned entrepreneurs and Ivy League universities (Founders in bold are serial entrepreneurs)[71]

Company	Founder	Background	Other company founded	Experience in the industry
US				
Airbnb	*B.Chesky* *J.Gebbia* *N.Blecarczyk*	Rhode Island School of Design Rhode Island School of Design Computer engineering		
Akamai	*T.Leighton* *J.Seeling*	MIT Stanford, MIT		ECI Telecom
Apple	*Steven Paul Jobs,* *Steve Wozniak* *Ronald Gerald Wayne*	Dropped out from Reed College in Portland UC Berkeley		Atari Atari Atari
Amazon	*J.Bezos*	Princeton		D.E Shaw, hedge fund
AppAnnie	**B.Schmitt**	Wharton School, University Of Pennsylvania	Neocom Multimedia, Arkadia Netsystems	Mobile industry
Cloudera	**A.Awadallad** **M.Olson** **C.Bisciglia** **J.Hammerbacher**	Stanford University of California Harvard	VivaSmart Sleepycat Prior Hive, Cassandra	Yahoo Britton Lee Google Facebook
Cyanogen	*K.McMaster* *S.Kondik* *K.Dutta*	Dalhousie University (Canada) Stanford Michigan State University		Mobile telecom Samsung Mobile, Internet Services Mobile industry

[71] Naspers is not included as it was irrelevant for a company founded in 2015.

Company	Founder	Background	Other company founded	Experience in the industry
Facebook	**M. Zuckerberg** *A. McCollum ,* *D.Moskovitz, C.Hughes E.Saverin*	attended Harvard University Harvard Harvard		Facemash
Flurry	**D.Scholnick,** *S.Byrnes,* *G. Vanrenen*	Harvard Business School Cornell Dartmouth College	Wily	Trinity, Verizon
Google	*S.Brin* *L.Page*	Stanford Stanford		
Meerkat	**B.Rubin** **R.Tirosh** **I.Danino**		AIR, Yevvo AIR, Yevvo AIR, Yevvo	
Storm8	*P.Tam*	Cornell		Facebook
Twitter	**Evan Williams,** **Biz Stone**, attended, but did not graduate from, both North-eastern University and the University of Massachusetts Boston *Jack Dorsey,* **Noah Glass**	 Missouri University of Science, Technology then to New York University	Services on the Internet,Blogger Company in 2000 Xanga, Blogger, Odeo. Macromind, Flash animation, Odeo	
Uber	**T.Kalanick** **G.Cam**		Red Swoosh StumbleUpon	
Zynga	**M.Pincus** *R.Davis* **C.Lee**	Harvard, Wharton Tulane University, Harvard Stanford	Tribe.net, Support.com, Free loader Support.com	 Yahoo
Asia & ROW				
Alibaba	*J.Ma* *J.C.Tsai*	Hangzhou Teacher's Institute Yale Law School		Investment bank
Baidu	*R.Li* *E.Xu*	Peking University, University of Buffalo Peking University, Texas A&M University, University of California, Berkeley		Infoseek, software development QIAGEN, Inc. and Stratagene, Inc, two biotech start-up companies

Company	Founder	Background	Other company founded	Experience in the industry
Flipkart	*S.Bansal and B.Bansal*	Indian Institute of Technology, Delhi		Amazon
Garena	*F.Li*	Stanford		
Kakao	**B.S Kim**		Hangame	Samsung
Tencent	*P.Ma* *Z.Zhidong*	Shenzhen University South China University of Technology, Shenzhen University		Telecom Telecom
Xiaomi	**J.Lei**	Sun Ya Tsen University, Drexel University	Kingsoft, Joyo.com,	Microsoft, Google
Yodo1 (China)	*H.Fong* *J. Lalonde*	Swinburne University of Technology (Australia) University of Texas at Austin		Microsoft, Brocade Microsoft, Brocade, EDS
EU				
Buongiorno	*M. Del Rio*	Cefriel/Politecnico University (Italy).		Accenture, Ote Telecomunicazioni/ Marconi Group -
Criteo	**J.B Rudelle** *R.Niccoli* *F. Le Quay*	Engineering school, Ecole des Mines, Paris Ecole des Mines, Paris	K Mobile Kiwee	A.D. Little; Philips, Lucent Microsoft Microsoft
King	*R.Zacconi* **S.Knutson**	LUISS, Italy Lund University	Fjord Network, Spray Ventures	uDate, Spray Networks
Rocket Internet	**O.Samwer**	Otto Beisheim School of Management	Alando	eBay
Shazam	*A.Wang*	Stanford		Signal processing
Spotify	**D.Elk** **M.Lorentzon**	KTH Royal Institute of Technology (uncompleted degree) Chalmers university of technology, Gothenburg School of Economics	Adevertigo Tradedoubler Tradedoubler	µTorrent Cell Ventures, Telecom: Telia, Altavista

Source: compiled by the author from references listed in the case studies, companies' websites, and Crunchbase. The serial entrepreneurs are in bold in the table, the remaining in italics.

The importance of this kind of background and technical expertise is also emphasized in the Atomico Report (2015) that notes that "*144 out of 156 (92%) companies started out with a tech- or product-driven founding team, signalling the overwhelming likelihood of success in technology with engineers at the top*".

With regard to location, Atomico has been saying since its first report that, although Silicon Valley was obviously important, the majority of companies (65%) originate from other places. For the EU, Atomico highlights the role of "*tech hubs like Berlin, Helsinki, London and Stockholm*".

Still, Atomico acknowledges that "*in absolute terms, Silicon Valley is the single most prominent tech hub with 54 companies*[72]*. The top six hubs are rounded out by Beijing (17), New York (7), Stockholm (5), Los Angeles and London* (4)". Within Silicon Valley, Stanford dominates the other universities and seems to be the stronghold of the cluster.

2.3 An R&D-intensive environment

Since a large number of the companies in our sample were started by tech savvy individuals, these companies are expected to be hi-tech and invest heavily in R&D.

Convincingly, from our sample, 11 companies are ranked in the global top 2,500 R&D investors (2015 Scoreboard, see Table 11)[73]. 10 of our companies are among the top 500. 7 out of the 11 unicorns ranked in the top global 2,500 R&D investors are US companies. The GAFA companies are all in this list, all four were in the top global ranking from 2014 to 2015.

Amazon has the lowest R&D intensity. Twitter and Zynga, however, have very high R&D intensities[74]: the former 52.4% of sales, the latter 57.4%. Ratios of a similar magnitude were identified in the Twitter case study for 2014 and 2013, respectively 49%, and 38% (See Part II of this report).[75] For Zynga, expenses were even higher in 2012 and 2013 (Annual Reports). Video games companies are R&D-intensive but their expenditures are often difficult to track, or to define properly[76]. As a comparison, the average R&D intensity for the 100 top global R&D investors is 6.5% (Scoreboard: 25).

Akamai had an R&D intensity slightly under this average: 6.4%. As of 31 December 2014, the company had 1,337 research and development employees; research and development expenses were USD 125.3 million (Annual Report, 2014)[77].

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[72] Out of 140 in this particular version of the Atomico report.

[73] The 2015 EU R&D Scoreboard (the Scoreboard) reports economic and financial information on the world's top 2500 R&D investing companies over the last fiscal year (2014). It comprises 608 companies based in the EU, 829 companies based in the US, 360 in Japan and 703 from the rest of the world. The complete data set is freely accessible online at: http://iri.jrc.ec.europa.eu/scoreboard15.html

[74] R&D intensity is the ratio between R&D investment and net sales of a given company or group of companies (Scoreboard: 105).

[75] Due to different national accounting standards and disclosure practice, companies of some countries are less likely than others to disclose R&D investment consistently. The San Francisco based company has a rather broad definition of R&D expenses that includes benefits and stock-based compensations for researchers: "*Research and development expenses consist primarily of personnel-related costs, including salaries, benefits and stock-based compensation, for our engineers and other employees engaged in the research and development of our products and services*" (Twitter, Annual Report: 54). Google does the same. Zynga R&D intensity is critically commented in the specialised press: see for example http://www.investopedia.com/stock-analysis/033015/zyngas-costs-are-out-control-znga.aspx

[76] As noted above for Twitter and Google, this is often an issue with growth companies, which tend to blend R&D expenditures with other business expenditures.

[77] To be noted this figures from the annual report differs from the figures given for Akamai in the scoreboard.

Table 11: World rank of the unicorns in the top R&D investors (2014)

R&D exp. world rank	Name of company	Country	R&D exp. 2014	R&D y-o-y growth	R&D intensity 2014	Sales 2014	Sales 1 year growth
			(EUR million)	(%)	(%)	(EUR million)	(%)
6	GOOGLE	**US**	8,098.2	24.3	14.9	54,362.1	18.9
18	APPLE	**US**	4,975.7	35.0	3.3	150,560.0	7.0
55	FACEBOOK	**US**	2,195.9	88.4	21.4	10,267.7	58.4
131	BAIDU	**China**	939.7	69.9	14.2	6,602.7	53.6
132	TENCENT	**China**	934.4	52.2	8.8	10,624.7	30.6
182	TWITTER	**US**	605.8	19.0	52.4	1,155.6	111.0
206	AMAZON	**US**	528.0	10.3	0.7	73,295.4	19.5
306	ZYNGA	**US**	326.6	-4.0	57.4	568.7	-20.9
492	AKAMAI	**US**	178.2	21.4	11.0	1,617.6	24.5
561	KING	**SW/UK**	152.3	60.1	8.2	1,861.7	20.0
1502	CRITEO	**France**	41.4	32.2	5.6	745.1	67.8

Source: http://iri.jrc.ec.europa.eu/scoreboard15.html

From Asia, Baidu is 4th among those unicorns ranked and 131st globally, up from 203rd in 2014. Baidu Research comprised three labs: the Silicon Valley Artificial Intelligence, the Beijing Deep Learning Lab, and the Beijing Big Data Lab. The company spent USD 1,125 billion on R&D in 2014 (over 14% of its total revenues). Tencent ranks 5th among unicorns and 132nd of the 2,500 global-level companies, up from 179th in 2014. Both companies illustrate the strong emergence of Asian players in the digital industries.

More than 50% of Tencent employees are presented as R&D staff (see case study). Tencent has obtained patents in many areas: instant messaging, e-commerce, online payment services, search engine, information security, gaming, etc. In 2007, Tencent invested over RMB 100 million in setting up the Tencent Research Institute, China's first Internet research institute, with campuses in Beijing, Shanghai, and Shenzhen. The institute focuses on the self-development of core Internet technologies, in pursuing its development and innovation for the industry. In 2014, Tencent was among the top 50 filers of applications under WIPO's Patent Cooperation Treaty (PCT).

In Europe, Criteo (France) qualified for the 2015 Industrial Scoreboard (though it had not done so in 2014) with R&D expenditures in 2013 of USD 41.4 million, a 5.6% R&D intensity (7.24% in 2013), an R&D centre in Paris (10,000 m² and 200 software developers among 1,000 employees), and an R&D centre in Palo Alto.

Two other companies do not disclose information about R&D: Xiaomi, and Alibaba. Xiaomi does not disclose data on R&D yet and hence does not show in the Scoreboard. When it announced it had set up a factory in India in August 2015, the company indicated that this entity will have "*local R&D and manufacturing*". The company may not be overly R&D intensive - Xiaomi has a low-cost business model and avoids marketing costs and probably R&D expenses as well. It is often said that it copies Apple, which may reduce its R&D costs. Alibaba does not show up on the scoreboard either. Nevertheless, its consolidated results show that "product and development expenses" constitute around 10% of its 2014 revenues and under "technology", the company says it employs 8,000 "engineering and data analysis personnel" out of 22,000 employees (SEC Filing: 210). None of the other unicorns of our sample disclose data on R&D.[78]

[78] The explanation might be purely methodological. The data for the Scoreboard are taken from companies' publicly available audited accounts. The Scoreboard relies on disclosure of R&D investment in published annual reports and accounts. Therefore, companies which do not disclose figures for R&D investment are not included in the Scoreboard.

3. De Interpretatione: what can explain the unicorn phenomenon?

The previous chapter gathers elements from the case studies. This chapter attempts to put unicorns into a broader perspective so as to better explain the phenomenon.

The lack of precision when describing unicorns as tech companies is not new. "*Calling practically all growing contemporary businesses 'technology companies' is about as useful as calling the enterprises of the industrial era 'factory companies.'* (A. Payne, quoted by Kerstetter, 2015).

Adding "platform" to technology may not be highly illuminating either. The CEO of Uber has reportedly described his company as a "platform". Almost all the companies in our sample could probably be described as some kind of platform and, as a result, the term brings little to the table. Unicorns have also often been associated with the concept of the sharing economy. Any systematic approach of this kind to the phenomena again leads to useless simplification.[79]

This leaves us with the above question: what can explain the unicorn phenomenon?

The following sections are the author's interpretation of the global technological and economic context, and how this context may have driven the rapid and growing emergence of highly valued young tech companies worldwide.

The first section explores how unicorns have built on the latest technological wave, the mobile internet wave. The second focuses on economic trends which have probably also served as building blocks.

3.1 The technological trend: unicorns are surfing on the internet mobile wave

The "mobile wave" may offer an interpretative framework for the unicorn universe, especially with the deployment of the mobile Internet.

Lee (2015) finds nine "decacorns" (companies worth over USD 10 billion) in her 2015 list and she notes that five of the nine are largely mobile (Uber, Twitter, WhatsApp, SnapChat, Pinterest). She considers that mobile technology is about to blossom and is likely to trigger the creation of start-ups. She notes: "*History suggests the 2010s will give rise to a super-unicorn or two that reflect the key tech wave of the decade, the mobile web. Whichever company (or companies) comes to represent this key innovation (Uber?), it will probably continue to accelerate in value as FB, Google and Amazon have over the past decade*" (Lee, 2015).

The link that Lee makes between a decade and a technology, whether it is robustly grounded or merely an inspiring analogy, offers the following hypothesis: different generations of start-ups ride different technological waves and benefit from the specific opportunities enabled by the technology.

The major rise in start-ups and unicorns (a 115% increase between Lee's 2013 and 2015 lists) may signal that the current technological wave (Internet mobile/mobile-app economy/smartphone) could have brought down the cost of entry, typically for "apps" like games, or chat. During the previous wave (i.e. the Internet wave 1995-2005, see Figure 7), companies like Amazon had to invest heavily in logistics and infrastructure to enter the book market. Today, apps developers can enter the market at a much lower cost as shown by mobile games companies Garena, Kakao, King, Storm8, and Zynga[80].

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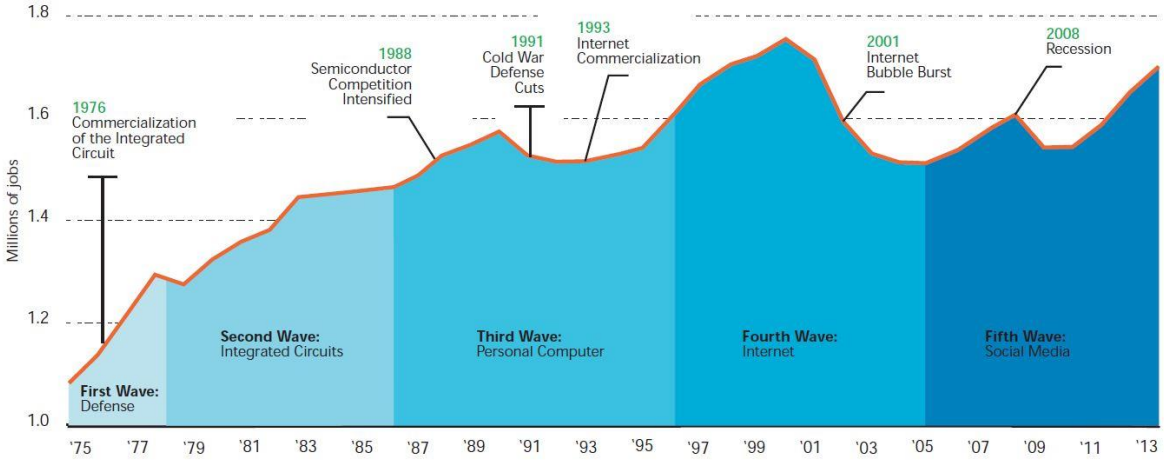
[79] We briefly discuss whether or not these two concepts explain the unicorn phenomenon in the Annexes to this report.

[80] One can note that in 2014, *Flappy Bird*, a 2013 mobile ads-based game developed by an unknown Vietnam-based developer became the most downloaded free game in the iOS App

Compass (2015) matches successive technology waves to employment developments in Silicon Valley (Figure 7). The companies involved are shown in the table below. We believe that the last wave, labelled "social", could be better described as "mobile."

Figure 7: The evolution of Silicon Valley: successive waves



Key Companies/ Organizations

1950s-1978	1979-1986	1987-1996	1997-2005	2006-2013
Stanford Research Institute, NASA, Ames, Lockheed Missile and Space Division, FMC/United Defense, Stanford Industrial Park: including Varian Associates, HP and others	Shockley Semiconductor, Fairchild Semiconductor, Intel, AMI, National Semiconductor; over the period more than 50 firms were working to develop or produce semiconductors in Silicon Valley	Xerox Park, SRI, Homebrew, Computer Club, Apple with at least fifteen more computer companies active in the region.	Netscape, Mosaic communications, Cisco, Google, SRI were key innovators; hundreds of companies active in the region.	LinkedIn and Facebook scaled their business in Silicon Valley; joined now by hundreds of social media companies.

Source: Global start-up ecosystem ranking (Compass, 2015: 15).

Of course, mobile communications have been around for decades[81] and the growth of the mobile markets had already allowed the creation of companies like Vodafone (founded in 1991[82]) in Europe, America Movil[83] (founded in 2000) in Latin America, and VimpelCom (founded in 1992[84]) in Russia. These are today three of the largest mobile telecom operators.[85]

Store, amassing in 2014 over 50 million downloads, two to three million downloads per day and USD 50,000 in revenue per day (Do, 2014b).

81 The first generation (1G,) using analogue technology, was commercially launched in the early 80s, to be replaced by the second generation (2G) based on the GSM, a digital standard developed by the European Telecommunications Standards Institute (ETSI) and first deployed in 1991. Subsequently, the 3rd Generation Partnership Project (3GPP) developed third-generation (3G) UMTS standards followed by fourth-generation (4G) LTE Advanced standards, which do not form part of the ETSI GSM standard (Source: Wikipedia).

82 Operated as Racal Millicom from 1982 to 1991. Went public in 1999.

83 Invested USD 40 million in Shazam in 2013.

84 Went public in 1996.

85 Respectively the second, fourth, and sixth largest mobile telecom operators. We will see later that Chinese operators do rather well (See 3.2.1)

With the introduction of 3G[86], the term "mobile broadband" was introduced because of its speed and capability.[87] However, the pace and nature of the markets changed with the introduction of the iPhone in 2007.

This section attempts to account for this global trend. The first part describes the deployment of networks and devices, focusing on smartphones. The second part follows the advent of apps. The third part identifies the way the companies in our sample have been riding this new mobile wave – or not.

3.1.1 The deployment of mobile Internet, the role of smartphones

Smartphones are game changers. Access to the new functions and facilities offered by smartphones were enabled by the deployment of new mobile networks: the mobile internet. The smartphone (the iPhone, and the Android family) combines the abilities of a PDA[88] with a mobile phone, leading in turn to widespread demand for mobile internet connectivity. The release of the Apple iPhone in late 2007 played a major role in triggering a migration towards new uses because it provided a convincing approximation to the familiar wired Internet. In turn, data traffic growth in mature markets accelerated (West and Mace, 2009: 16).

Smartphones now account for more than 40% of the world's active handsets (i.e. handsets connected to an active mobile subscription). However, they accounted for 75% of sales for the first quarter of 2015 (Kemp, 2015a). 2.6 billion smartphones were sold in 2014 (GSMA Mobile Economy 2015: 6).

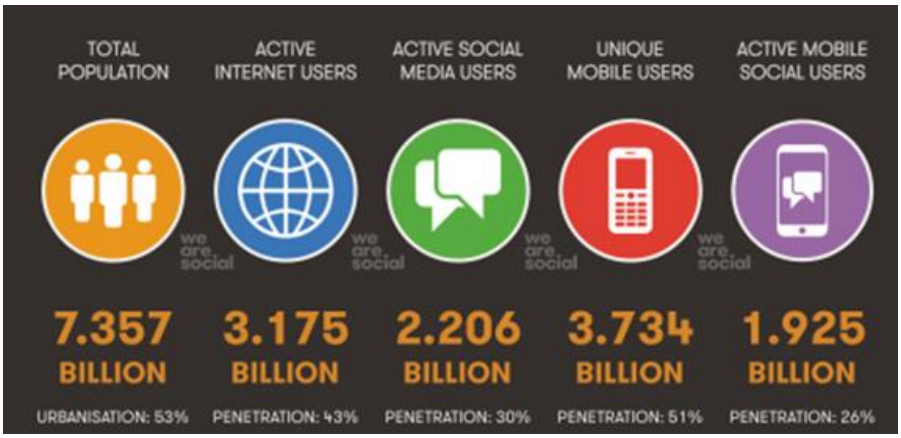
The phenomenon gained pace with cheaper handsets and more affordable data connections, allowing access to an array of new apps. Figure 8 sums up this trend: as of August 2015, there were 3.7 billion unique mobile users and 7,529 billion SIM connections, which is slightly over the total world population of 7,357 billion (Kemp, 2015a). Cisco (Cisco Visual Networking Index) attributes this impressive growth of mobile data traffic to a combination of trends, among which: the transition to smarter mobile devices, a move toward the Internet of Everything, video dominance, and the adoption of IPv6. Faster higher bandwidth and more intelligent networks paved the way for a wide adoption of advanced multimedia applications that contribute to increased mobile and Wi-Fi traffic. Smarter devices and updated networks can accommodate mobile video content with much higher bit rates than other mobile types, thereby generating much of the mobile traffic growth expected up until 2018 according to Cisco (2014: 13).

[86] 3G launched in 2001: HSPA, EV-DO. IMT 2000 standards, a family of standards (EDGE and CDMA).

[87] The latest mobile generation has been enabled by the deployment of new networks (4G and soon 5G) characterized by faster higher bandwidth and more intelligent networks, which allow the deployment of the mobile Internet (or mobile broadband).

[88] Personal digital assistant, also known as a handheld PC.

Figure 8: Digital, social and mobile usage (August 2015)



Source: Kemp (2015a).

Kemp (2015b) reports that mobile internet access grew exponentially in 2014, "with 39% of all global mobile connections now classified as 'broadband' (i.e. 3G or 4G)"[89]. Currently there are 2.9 billion mobile broadband subscribers worldwide, and the numbers of mobile broadband subscriptions are currently growing by 30% year-on-year and with 50 million new subscribers every month. Figure 9 shows the penetration in different regions of the world: there is still room for growth, especially in the developing economies with 48% penetration in Southeast Asia, 53% in East Asia, and 57% in South America. Mobile broadband is now also widely available in less developed countries.

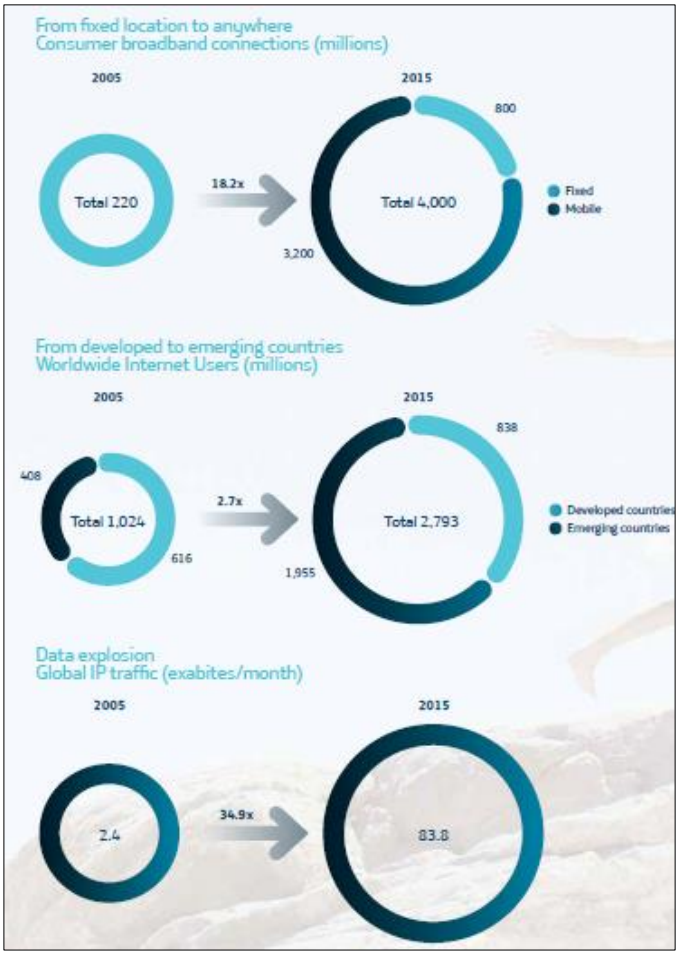
Figure 9: Mobile broadband deployment (January 2015): % of active 3G and 4G mobile connections to total active mobile connections

Source: Kemp (2015b).

Between 2012 and 2016, the number of internet users worldwide is expected to double to some 5 billion people, and most of the new arrivals will be on mobile devices in emerging markets (Quartz India, 2015). As stressed by Telefonica's Digital Manifesto (2014), the "old Internet" was fixed, whereas the new Internet is mobile, data centric and led by emerging countries (see Figure 10). In 2012, total global telecom spending amounted to USD 1,574 billion, of which mobile accounted for USD 925 billion (voice: 600, data: 352), and fixed for 622 (voice: 317, data: 305) (Digital Manifesto, 2014: 19). The former is increasing, the latter decreasing.

[89] Although at varying speeds.

Figure 10: From the "old" Internet to the new Internet



Source: Digital Manifesto (Telefonica, 2014: 21).

3.1.2 The rise of the apps economy

Smartphones and Apps

Smartphones and the mobile internet saw the advent of applications (or "Apps") for the consumer. The development of Apps accelerated the growth of an already rapidly expanding market for smartphones. Within five years (July 2008-October 2013) the number of apps available for download on the Apple platform had grown from 500 to more than 1,000,000 with 60 billion downloads in total (Appnation, 2013). As of 2015, there were 3.1 million apps available (1.6 million in Android, 1.5 million on IOS) (Mehra, 2015).

In 2011, global mobile app revenues amounted to USD 8.32 billion, they reached USD 34.99 billion in 2014 and are expected to more than double by 2017, reaching USD 76.57 billion (Mehra, 2015). The market research company Vision Mobile (2014) estimated that there are already over 100 billion downloads a year. App usage is fuelling the growth of mobile.

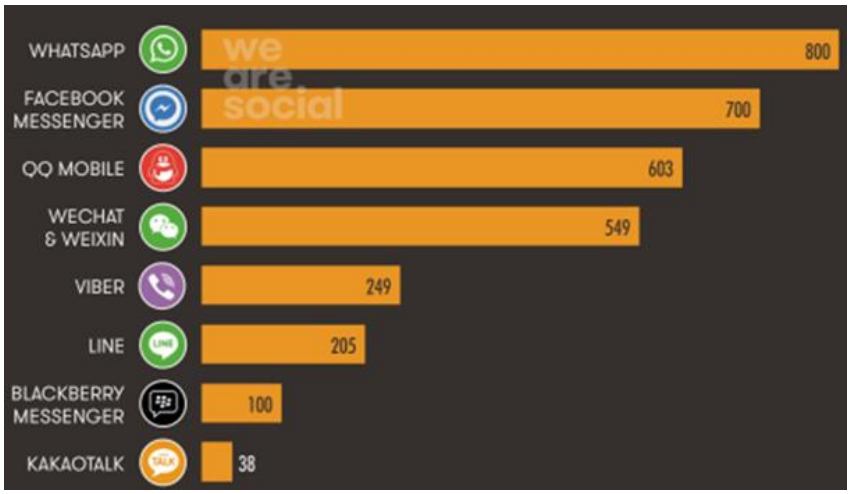
A 2014 study (Mulligan and Card, 2014), carried out by GIGAOM and NUI Galway for the European Commission, assessed revenues for apps at EUR 17.5 billion in 2013 and forecasted EUR 63 billion by 2018. Three of the top-five European companies are Nordic games developers (1st King.com - 2nd; Supercell - 5th Rovio).

The success of messaging apps (including social and photo sharing titles) is having a particularly significant impact. Some messaging apps, such as LINE and KakaoTalk, have started to evolve into platforms[90] (see Kakao Talk in Part II of this report), rather than standalone apps with the inclusion of games and sticker stores. In March 2014, LINE claimed it had had 100 million games downloads via its messaging app.

The strategic business role of messaging apps came to the fore with the wave of exits and investments in the messaging app arena: Facebook acquired WhatsApp for USD 19 billion; Rakuten acquired Viber for USD 900 million; Alibaba invested USD 215 million in Tango (Wee, 2014).

Kemp (2015a) notes that the growth of mobile-centric 'chat apps' is overshadowing the growth of more conventional PC-based social networks. WhatsApp is the world's fastest growing 'big' platform with 800 million active users (Figure 11 indicates the ranking of these platforms with more than 100 million new active users). Kemp indicates that WeChat/Weixin, a Tencent app, have added 150 million users around the world in the past 12 months, which roughly translates to a year-on-year growth of 39% (see Box 10)[91]. The second most popular chat app, QQ mobile in Figure 11, is also a Tencent application. The apps economy is obviously one of the current building blocks of the unicorns' universe.

Figure 11: Active users (in million) for chat apps (August 2015)



Source: Kemp (2015a).

Connie Chan (2015), a partner at VC Andreessen Horowitz, attributes the success of WeChat (7 times the ARPU of WhatsApp, see Box 9), to a combination of elements: "*WeChat reveals what's possible when we take a mobile-first approach to platforms, portals, social networks, and brands*". She further stresses: "*Ultimately, however, WeChat should matter to all of us because it shows what's possible when an entire country — which currently has a smartphone penetration of 62% (that's almost 1/3 of its population) — "leapfrogs" over the PC era directly to mobile*". This argument places unicorns in the global economic context and is presented below.

[90] Apps start by offering a single service like messaging or games. Then new functionalities are added, turning the initial app into a multifunction platform.

[91] Box 9 is a reduced version of the box included in the Tencent case study.

Box 9: WeChat, a vision of a mobile lifestyle managed entirely through smartphones

WeChat is a messaging app for sending text, voice, and photos to friends and family. In 2011, WeChat launched the most popular messaging app in China. It was called QQ — and it was produced by Tencent. QQ started on the desktop and made its way onto feature phones in 2003 and smartphones in 2008. But when Tencent realized how game-changing the smartphone really was, they decided to tackle the problem with a blank slate rather than have the QQ team try to create a better smartphone app. WeChat was created by an entirely new group of Tencent employees, who were tasked with designing a mobile messaging service without the legacy of PC.

WeChat's average revenue per user or ARPU is estimated to be at least USD 7— that's 7 times the ARPU of WhatsApp, the largest messaging platform in the world. By early 2015, WeChat had 549 million monthly active users (MAUs) among over one billion registered users, almost all of them in Asia.

Downloading the app is free. It offers more functionality… all in a single, integrated app. Along with its basic communication features, WeChat users in China can access an array of services. WeChat has focused on building a mobile lifestyle — its goal is to address every aspect of its users' lives, including non-social ones. The way it achieves this goal is through one of the most unsurfaced aspects of WeChat: the pioneering model of "apps within an app". Millions (not just thousands!) of lightweight apps live inside WeChat, much like webpages live on the internet. This makes WeChat more like a browser for mobile websites, or, arguably, a mobile operating system complete with its own proprietary app store. The lightweight apps on WeChat are called "official accounts". Approved by WeChat after a brief application process, there are well over 10 million of these official accounts on the platform. For the end-user, adding an official account is as simple as adding a friend. WeChat, to make its official accounts platform work, had to move beyond the framework and limitations of a social network — where content is king — to a system that prioritized usefulness and functionality above everything else.

The cornerstone of this model is payments, which are managed through a portal that lives in a completely separate part of the app from official accounts (yet is still readily accessible). This portal takes the form of the WeChat "Wallet", which is not a traditional wallet but a menu of carefully curated, pre-selected service providers that users can transact with after inputting their payment credentials. The WeChat Wallet menu has several portal-like characteristics. At least one in five active WeChat users is set up for WeChat "Payments". The resulting user adoption and portal model has given Tencent a kind of "king-making power" for Chinese apps (and by association, internet start-ups in China) because partner companies selected to be part of the WeChat Wallet portal get instant exposure to hundreds of millions of users.

With WeChat, mobile doesn't just navigate, but moves into the physical world: offering online-offline integrations. So where most US apps confine the smartphone camera to just taking photos of people and places, WeChat engages the camera to scan English text and translate it into Chinese, or to pay directly for a transaction. WeChat also better utilizes all the other smartphone sensors as sources of data input. For example, it uses GPS when users search for businesses nearby, calls upon the microphone to identify a TV show or a song on the radio, uses the accelerometer when a user shakes the device to find strangers nearby to chat with, uses Bluetooth when users add friends in their vicinity.

Research from GlobalWebIndex suggests that more than 6 in 10 internet users in China used WeChat in the past month (Kemp, 2015c).

Source: C. Chan (2015)

3.1.3 Are all unicorns born mobile?

Mobile Internet is the technological wave "of the decade". It builds on two major opportunities: a fast growing market of consumers and room for new businesses and business models.

Hence, looking at the distribution of "mobile" and "non-mobile" unicorns would be relevant. All these companies rely now, in one way or another, on a mobile dimension (Apps, platform, service…), though they may not have done in the past. In Table 12, mobile unicorns are listed in the left column with the date they were founded. If they were not born mobile, the year they went mobile is marked M(year), where this information is available.

This classification yields an interesting pattern, (see Table 12): 20 out of our sample of 30 companies (with the "gems") can be classified, one way or another, as "born" or "turned mobile". Some of the companies we have included under mobile were not initially "mobile" but turned mobile after both Apple and Google went "mobile", having themselves reshuffled their businesses in that direction (the former did this by opening departments, and creating new lines of products; the latter by buying firms like Android, a mobile software company in 2005, and Motorola in 2011).

Table 12: The mobile divide (Gems included)

Born Mobile	Turned mobile	Becoming mobile
US		
Flurry (2005) Twitter (2006) Zynga (2007) Cloudera (2008) Uber (2009) Storm8 (2009) Cyanogen (2009) AppAnnie (2010) Meerkat (2015)	Apple (1976 – M2007) Google (1998- M2005) Facebook (2004 – M2012)	Amazon (1994 – M2007) Akamai (1998 - NA) Airbnb (2008- NA)
Asia		
Kakaotalk (2006) Garena (2009) Xiaomi (2010) Yodo1 (2011)	Tencent (1998 – M2003)	Alibaba (1999 – M2010[92]) Baidu (2000-M2009[93]) Flipkart (2007-NA)
EU		
Buongiorno (1999) King (2003)	Shazam (1999 – M2007)	Criteo (2005-2013) Spotify (2006- NA) Rocket Internet (2007-NA)
RoW		
		Naspers (1915-NA)

The mobile dimension became pivotal for all the sampled companies. Some companies were born mobile, others were initially non-mobile but later became mobile. This section focuses on the latter: i.e. on unicorns that have transformed from "PC-based / fixed internet" to "mobile" since 2007.

[92] One can tentatively date the turn to mobile to the launch of the 2010 Mobile Taobao App.
[93] Most likely the year of introduction of Baidu Mobile Search as the company signed up with China Telecom and China Unicom that same year.

GAFA companies were all non-mobile but they all became mobile in the first decade of 2000 by introducing new devices and services. In a way, Apple triggered this turn to mobile with the release of the iPhone in 2007, a move that the legacy telecom players did not expect. In July 2005, Google had acquired Android Inc., a Californian start-up founded two years earlier to set up a mobile operating system (OS) based on the Linux kernel. Google created the Open Handset Alliance to create a momentum with other industry players (e.g. HTC, Sony, and Samsung) and telecom operators. In 2008, HTC Dream released the first commercially available smartphone running Android. In 2010, Google launched its Nexus series of devices.

In 2004, Amazon set up a lab in Silicon Valley that would build its first piece of consumer hardware, a device for reading digital books. In 2007, Amazon launched this first mobile device: the Kindle eBook reader (Simon, 2015). Amazon created at the same time an entire sophisticated ecosystem around the mobile device with Amazon Publishing (created in 2009) and thirteen other imprints, tools for self-publishing, giving access to hundreds of thousands of books to borrow and read (for free for Amazon Prime subscribers) on a Kindle device. Amazon has been trying to duplicate this successful ecosystem with the introduction of another mobile device in 2014, the Kindle Fire TV, for TV, movies and games, introducing tools for production, moving into content production under the flagship of Amazon Studios (created in 2011).

With the acquisitions of WhatsApp and Instagram, Facebook turned mobile and also enhanced its mobile profile. "Mobility" now accounts for 60% of the revenues, according to Ezratty (2015). According to company data (Annual Reports, see case study) for March 2012, over 50% of the 526 million users accessed Facebook through their mobile, 63% one year later.

Akamai claims to lead the mobile market by serving over 200 billion API calls, over 145 TeraBytes of mobile app data and thousands of mobile sites on its Akamai Intelligent Platform every day. On 11 July 2013, Criteo, to accelerate its mobile strategy, acquired all of the shares of Ad-X Limited, a mobile analytics and attribution technology company.

Regarding the BAT, Alibaba is leading in mobile commerce in China and its revenues are shifting more and more towards mobile. In August 2015, for the first time, the company announced that its mobile revenues accounted for more than 50% of its total commerce revenues in China (Custer, 2015).

In 2003, Tencent turned mobile successfully with both the creation of We Chat/Weixin and the development of mobile games. In 2013, Tencent launched games centred on Mobile QQ and We Chat/Weixin invested in Garena.

Still in Asia, Rocket Internet's Indian subsidiary, Lazada, derived nearly 60% of its revenues from mobile (Millward, 2015a). All the e-commerce companies are addressing this shift to mobile.

A number of companies in our sample – particularly all the games companies (Garena King, Storm8, Yodo1, Zynga) - started as mobile game companies. Mobile is linked to the realm of the freemium business model on which video game companies have relied. While not really born mobile, Shazam was created in 1999 as a dial-up service but only exploded with the launch of the app store in 2008, being one of the first apps in the brand new Apple App Store. Social networks like Facebook and Twitter followed the same trend. Mobile has become the primary driver of the Twitter business, generating significant revenue through mobile applications: in 2014, approximately 85% of advertising revenue was generated from mobile devices.

Xiaomi seems to have been born out of this mobile wave. It seized the technological and markets opportunities for budget iPhones initially in the fast developing Chinese mobile markets. Over the last five years, Xiaomi "has accomplished a lot more than pretty much any other half-decade-old company …While all that was happening, Xiaomi has pushed HTC to the edge of the abyss, terrified the life out of Samsung, and perhaps even given Apple some food for thought" (Millward, 2015b). Under this (very) simple categorization

Xiaomi, initially an equipment manufacturer, fits into the mobile section not only because it manufactures mobile phones, budget versions of the iPhone, but also because of its business model of flash sales (online/mobile). Xiaomi is now a mobile operator, operating as a mobile virtual network operator (MVNO), offering a suite of mobile services.

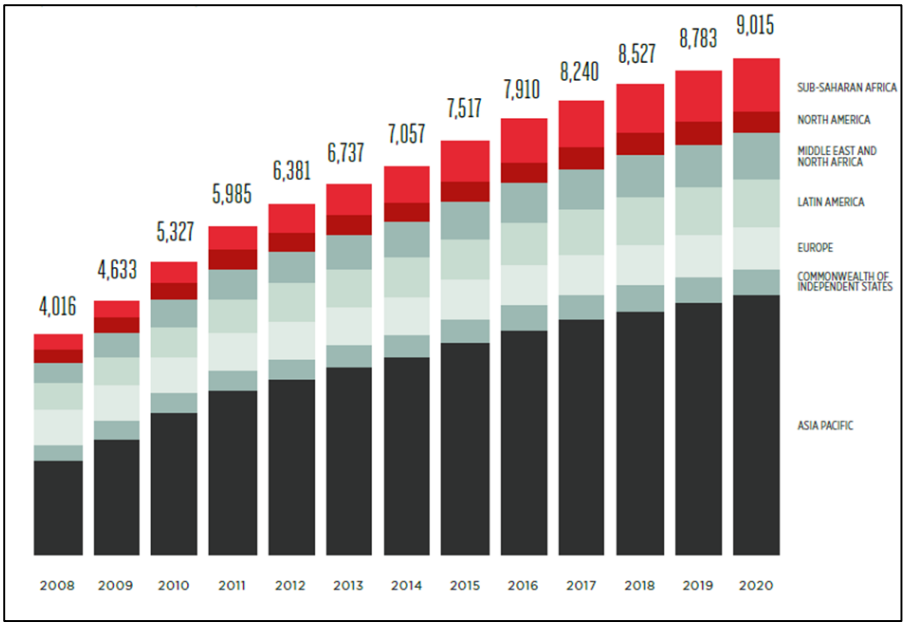
3.2 The economic trends

3.2.1 Unicorns go global to make the best out of leapfrogging

As stressed by GSMA (Mobile Economy 2015: 10), the technology migration toward 3G and 4G is having its greatest impact in the developing world. Asia lagged behind most developed countries (US, Europe) in the deployment of fixed networks; mobile allowed Asia to leapfrog these countries.

While European markets still lead the world in terms of unique subscribers penetration with a 79% penetration rate compared to a global average of 49% (GSMA Mobile Economy Europe, 2014: 9), the Asia-Pacific region accounted for over 50% of all mobile connections in 2014 (3.6 billion connection, 1.8 unique mobile subscribers) and is expected to further grow (4.7 billion connections and 2.4 unique subscribers forecasted by GSMA for 2020) (see Figure 12).

Figure 12: Global Mobile Connections (2008-2020)



Source: GSMA. The Mobile Economy 2015 (6). © GSMA Intelligence 2015.

China is the world's largest mobile market. Box 10 gives the main features of the Chinese market. In 2014, China Mobile was the world's largest mobile operator based on connections and annual mobile revenue (USD 108.64 billion[94]) (GSMA, 2014a). As summed up by Millward (2015b), "*China is making a huge shift to mobile*".

China and India are also the fastest growing mobile (data) markets in the world (De Prato and Simon, 2015). The Chinese Agency, CNNIC, (2014) reported that in December 2013 the Internet penetration rate was 45.8% and the number of Internet users in China had reached 618 million, of which the number of mobile Internet users had reached 500 million and was continuing to grow. The report stresses that "*mobile phones are still the main driving force for the growth of internet users in China*" as the proportion of Internet users that access the Internet on their mobiles is much higher than it is for other devices. In September 2015, the Ministry of Industry and Information Technology

[94] Annualised revenue for the period to Q2 2014. USD 90.44 billion in 2013 (Gillet, 2013).

(MIIT)[95] of the Chinese government said that there were 946 million mobile web users in China. The vast majority of them, more than 900 million, were accessing the web via mobile phones (as opposed to tablets or other mobile devices) (Custer 2015d) which means, as noted by Custer, that this figure will soon reach one billion, taking into account its growth rate. China is going through a rapid shift toward 4G and in September 2015, China had 270 million 4G users (Custer 2015d).

Box 10: The Chinese market (August 2015)

The key data are the following

a. Internet Users[96]: 668 million, a 6% year-on-year increase,
b. Social Media Users: 659 million – more than the USA and Europe combined,
c. Unique Mobile Users: 675 million, almost half the country's population now owns a mobile phone, and there are 1.3 billion mobile subscriptions. The number of mobile subscriptions in China is now very close to the number of people living in the country, which suggests that the average user still maintains close to 2 active connections.
d. Mobile Internet Users: 594 million, accounting for 89% of all China's internet users.
e. Mobile Social Media Users: 574 million, up 15 million since this time last year.

Social media usage in China is already very high, with the numbers suggesting that 99% of China's internet community uses social media of some description. Platforms like WChat and QQ Mobile together claim the second-place spot in the worldwide rankings, after Facebook. 87% of China's social media users now access via mobile devices at some point each month, and platforms like WeChat have helped to drive overall numbers up 77 million over the past 12 months.

Smartphones already account for a little less than two-thirds of all handsets in active use, and for 90% of new handset sales.

E-commerce more generally appears to be thriving in China, with almost one in three internet users buying online each month. China's mobile users also appear to have embraced m-commerce, with reports suggesting that 20% of the country's population have made a recent online purchase via their mobile devices. M-commerce is expected to account for half of all consumer e-commerce in 2015, up 85% from 2014.

Source: Kemp (2015c)

By 2017, it is expected that India's smartphone market will overtake that of the US, becoming second only to China. (Strategy Analytics, 2015). Already, 69% of Internet users in India access it via their mobile phones (McClelland, 2012). India had 405.5 million unique mobile subscribers in 2013 (GSMA, 2014b: 5). India's web traffic is dominated by mobile devices, with phones alone accounting for 72% of all web pages served in the world's second most populated country (Kemp, 2015a). In July 2015, India's government launched the Digital India initiative, with the support of companies like Tata or Wipro, to bring large sections of the unconnected population online: the thrust of this initiative will be largely mobile (Panwar, 2015).

India is considered as the last big Internet market. The explosion of smartphone sales has made the Internet accessible to hundreds of millions of as-yet untapped customers. Monica Peart, a forecasting analyst at eMarketer, states that "*The sheer number of mobile internet users pushes retail e-commerce activities towards mobile devices in a way that has not yet been seen in the US, where desktop computers still factor quite prominently for shopping activities,*" (quoted by Waring, 2015).

[95] The state agency of the People's Republic of China responsible for regulation and development of the postal service, Internet, wireless, broadcasting, communications, production of electronic and information goods, software industry and the promotion of the national knowledge economy, established in March 2008.

[96] As a comparison: they were in China 384 million Internet users, including 233 million mobile Internet users in 2011 (Simon, 2011).

Asia leads in the mobile markets. The penetration of mobile commerce in East Asia is higher even than that of the US (18%): mobile commerce in South Korea has a penetration rate of 37%, China 27%, Singapore 22%, and Hong-Kong 21% (Kemp, 2015b).

As stressed in Section 2.1, this impressive growth of the Asian mobile markets is one of the main factors that contributes to the success of the Asian unicorns.

3.2.2 Unicorns and the "transformation of everything else"?

The digital shift – that is the transformation of economic and social activities with the help of ICT technologies – has impacted the entire economy, albeit rather unevenly, as it varies across countries and sectors of the economy. [97]

Historically, digitization went through three phases when it left the core of IT-related activities (the ICT industries) and moved towards new sectors of the economy, according to Simon (2012, 2014) and Williamson (2015):

- During the first phase in the 90s, telecom operators started offering other services when deploying their broadband networks (ADSL), adding data and video services in bundles (triple or quadruple play) of voice communications and access.
- In the second phase after 2000, IT companies (search engines, e-dealers like Amazon and eBay, then social networks and manufacturers like Apple) took over and led the digitisation process of the media and content industries. Roughly after 2010, all the media sectors have witnessed new dynamics over the last few years,
- Aftern 2010, all the media sectors witnessed the new dynamics of the third phase, in which legacy players adopted less defensive, more proactive strategies.

The "third phase of convergence", according to Williamson, involves a blurring of the digital and physical world, see for example peer-to-peer services (e.g. Uber). In other words, we are moving towards "the transformation of everything else" (Williamson, 2015) that makes up most or all of the economy, particularly services. Schlafman[98] explains this shift as follows: on-demand mobile services (ODMS)[99] "*deliver a 'closed loop' experience by collapsing the value chain including discovery, order, payment, fulfilment (offline but within owned network) and confirmation*." Furthermore, he states that "*The U.S. economy is largely driven by the service sector so it's only a matter of time until all of our services are accessible via our mobile devices.*" Box 11 shows Schlafman's views about services that are currently undergoing digitization or will soon do so.

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[97] For instance, a report commissioned by the French government (IGF, 2012) stressed that digitization accounts for nearly 80% of the economy. It assessed its various impacts in the following fashion with the core of the digital economy representing around 5.2% of the GDP, 13% of R&D, 3.7% of employment, 4.4% of firms (core IT technologies and infrastructures, telecommunications, applications and computer services). Some sectors were greatly impacted by digitization (12% of GDP), some sectors were not profoundly changed (60% of GDP) and other sectors were barely affected (20% of GDP)

[98] A researcher at RRE New York Venture Capital.

[99] Defined as "*apps which aggregate consumer demand on mobile devices, but fulfil that demand through offline services"* (Ure, 2015: 35).

Box 11: Candidate activities for digitisation

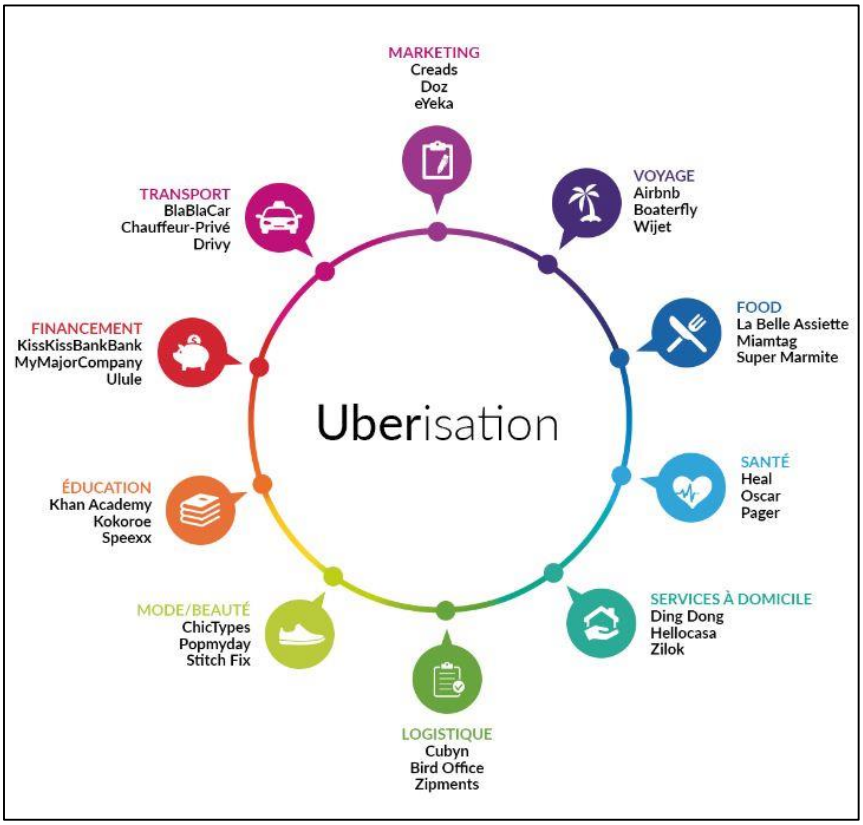
Schlafman identifies the following services as going through digitization:

- Transportation (black cabs, taxis, rideshares, scooters, buses, parking, private jets, bikes and rental cars),
- Home services (veterinarians, cleaners, baby sitters, handymen, movers, auto mechanics, locksmiths, laundry, iPhone repair, flowers, errands, dog walkers, and dog sitters),
- Delivery and logistics (package delivery, messengers, and local/ long distance shipping),
- "Hospitality" [100](hotel rooms, bed and breakfasts, and quiet spaces),
- Food and beverages (groceries, healthy food, fast food, and alchoholic drinks), dining
- Reservations, deals, dating, and payments,
- Entertainment (ticketing),
- Health and beauty.

Source: Schlafman (2015)

Figure 13 gives another overview of the sectors that are currently affected, based on the French case, and described by Creads as "uberisation".[101]

Figure 13: The "Uberisation" of some sectors



Source: Lea, Creads (2015).

[100] A nice euphemism to avoid any regulatory quagmire.

[101] Not to be confused with the term previously used by another author (Ezratty, 2014) in the context of fast market capitalisation.

In fact, there is a new category of services called O2O ("online to offline") that bridges the two worlds: a variety of e-commerce services that provide online information, services, or discounts to consumers that enhance their offline shopping experiences. Custer (2014c) quotes group buying sites like Groupon that provide online discounts for real-world shopping experiences like restaurants and cinemas. Custer (2015c) describes China's recent on-demand explosion as a craze: O2O start-ups have been popping up – and nabbing investor cash (O2O auto repair, O2O massage, O2O movie tickets, O2O food, and O2O education). Alibaba is investing in these start-ups. Baidu did the same, and is now rolling out its own set of mobile and O2O products, and related technology in new markets like Brazil (Coghlan, 2015).

China's recently launched Internet Plus Plan has also been described as "the uberisation of the Chinese economy." Pony Ma, the founder and CEO of Tencent, stated: "*The internet has opened new frontiers including internet finance, medical services and education that didn't exist before. It should also be extended to traditional industries like manufacturing, energy and agriculture*" (Innovationiseverywhere, 2015).

The Internet Plus Plan was designed to support this transformation, to boost a broad user-generated market. Unicorns, among others, may have benefited and often drive this digitization. All the unicorns extend the realm of digital products and services offered to new sectors and are therefore are at the root of the "*transformation of everything else*".

3.3 Conclusions

The above trends, both technological and economic, contain some of the most important factors that have shaped the unicorn phenomena (i.e. the accelerating growth of the numbers of technology companies that reach high market capitalisation).

We have seen earlier that these companies have characteristics in common: they tend to have been created by seasoned and educated business people, they receive a lot of VC funding, they aim mainly for organic growth and global reach, they address both private and corporate consumers, they reinvent the activities of many sectors across the economy, and strongly invest in R&D, etc.

This section supports the assumption that these businesses take advantage of:

- mobile internet-based applications,
- the opportunities for new and/or disruptive activities, in an increased number of sectors of the economy,
- the global diffusion of these technologies,
- the rise of large middle-class groups in emerging economies.

These businesses, to create ICT-enabled new products, services and business models require and attract a lot of financial support (VC). However, they also feed a possible irrational exuberance (valuations: see Box 3).

Their ability to meet their business goals and be resilient to a rapidly changing technological and economic landscape remains to be seen. The jury is still out. However, some of the most senior of these companies (Apple, Google, Amazon, Tencent, Alibaba, Buongiorno), all born before 2000, have already demonstrated their resilience and have also adapted to the constraints and opportunities of the third wave of digitisation, the decade of mobile internet. It would be naïve to underestimate the current and future capacity of these companies.

4. Conclusion: a role for policies?

4.1 Did Europe miss the mobile turn?

The developments following the mobile Internet wave have been largely market-led. In the telecommunications sector, most of the EU and US policies over the last twenty years have been designed for the fixed telecommunications market, whether they liberalize the sector or regulate it. Mobile telecommunications, however, started in a competitive environment and the need to intervene was hence less apparent. Public policies were more or less limited to competition law, if and when needed.

In the early 2000s, policies concentrated on the deployment of fixed networks. After the successful deployment of ADSL, they focused on encouraging the shift from high to ultra-high broadband fixed networks. In the US, a National Broadband Plan was adopted in 2010, following a hot debate about the US falling into a "broadband ditch" after the release of the 2007 OECD Broadband Statistics (Simon, 2010). The EU followed suit with the 2010 Digital Agenda. As in the US, some discussion took place about the EU lagging behind other OECD countries like Australia, Japan, South Korea and the US as regards broadband penetration. But was ultra-high fixed broadband the right issue to tackle?

These policies were supply-side policies designed to boost the development of infrastructures. This is surprising since the deployment of these networks were supposed to generate network effects known as "demand-side economies of scale", expected to play an important role in the economic analysis of the impacts of these digital technologies.

The disruption that took place in 2007 after the introduction of the iPhone feeds second thoughts about choosing a supply-side driven focus on fixed rather than mobile telecoms. This fixed broadband deployment policy may now be seen as having left some issues unaddressed.

There was no debate about *mobile* broadband nor were there, broadly speaking, pro-mobile policies. The issue of mobile was dealt with only to a limited extent in the support given to mobile broadcast TV[102]. In the EU, Mobile broadcast TV[103] has benefited from strong standardisation support since 2007 (DVB-H)[104]. However, despite attempting to use major events (Olympics, football league) for commercial launches, output has remained modest with limited response from EU markets (around 5 million users). This dead-end stemmed from divergent technological options (broadcasting vs mobile communications).[105]

However, the failure was also due to lack of perceived value and usefulness by users. Mobile TV belonged to the legacy broadcasting model (a push model). Users were at the time discovering and using the new capacities of their new smartphones, and enjoying the freedom to choose what to view and when (pull model). Mobile TV was another

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102 In December 2008, the Commission issued its « Legal Framework for Mobile TV Networks and Services: Best Practice for Authorisation – The EU Model".

103 Broadcast terrestrial mobile TV: mobile TV is based on a mobile broadcasting technology operating under digital video broadcasting (DVB) standards like DVB-H ((DVB transmission to handheld terminals) were pushed by the EC in 2007.

104 In 2006 the Commission encouraged the setting up of the European Mobile Broadcasting Council. Commission communication on EU policy for mobile TV (July 2007): "Strengthening the Internal Market for Mobile TV".

105 Even if the EC was pushing for standards, for the adoption of DVB-H standards, the situation was a mess of competing standards globally, coming from different horizons and regions: broadcast (DAB, DVB families), mobile (OMA Bcast, UMTS, MediaFLO, Wimax). DVB-H, DMB and MediaFLO all shared some similar flaws and were doomed to follow similar paths: technically they worked as mobile broadcast solutions using costly dedicated spectrum, by means of separate infrastructure that meant costly build-outs in order to achieve coverage levels that made services a viable proposition.

example of a supply-side policy that did not take into account changes in the patterns of consumption.[106]

Later policies designed to promote the shift from broadband to ultra-high broadband tell a similar story. The demand for ultra-fast broadband remained low whenever the networks were deployed. This was noted in the Digital Agenda Scoreboard as early as 2011. The 2014 Digital Agenda Scoreboard stressed the discrepancy between NGA[107] coverage and take up of fast broadband (at least 30Mbps): "*NGA is available to 62% of homes in Europe, but only an estimated 15% subscribe to fast broadband*" (Digital Agenda, 2014:). As Marcus and Elixmann (2014) note, usage in countries with an impressive deployment of ultrafast broadband, like Japan and South Korea, is not notably higher. In reality, 3G accesses have outnumbered fixed broadband subscriptions since early 2009 (ETNO, 2015: 22). Pew (2016: 2) reports that the share of Americans with broadband at home plateaued (down to 67% in 2014, from 70% in 2013). More Americans rely only on their smartphone for online access and 68% of them own one.

Customers did not find this increased bandwidth attractive. It offered few applications at a time when attractive mobile applications started blooming. In Europe, data from Vodafone showed that in the quarter ending September 2013, 75% of the company's data traffic in Europe was already video and browsing (GSMA, Mobile Economy: 18). Mobile video traffic exceeded 50% of total mobile data traffic for the first time in 2012 (Cisco VNI, 2013-2019, 2014: 1)

Ironically, though mobile broadcasted TV (the legacy push model) went nowhere, the adoption of mobile devices to watch video and TV-on-demand[108] (streamed: the new pull model) reached significant and unexpected levels. In 2014, 25% of French consumers used a mobile device to watch TV or video on a weekly basis. This figure was 27% in Germany and almost 42% in Sweden, the country with the highest 4G penetration rate.[109] In addition, though the distribution of movies on devices such as mobiles was once seen with scepticism, they are "*increasingly the place where young people in particular are choosing to watch film*" (M. Gubbins, 2014: 75).

The irony of this mismatch between supply and demand is that the growth of traffic was more and more consumer-led (Cisco), if not "prosumer"-led.[110] It was also media-led and video was the driver. Customers were using their new devices to produce and exchange their own contents. For example, YouTube, started with amateur short videos and smartphones triggered their migration to mobile[111]. In October 2014, YouTube announced that mobile devices generated 50% of its traffic, up from 41% in 2013 (GSMA, Mobile economy Europe 2014: 20). Though demand was not there for fixed traffic, it was overwhelming for mobile and for "attractive" apps, as soon as they became available. The unicorns described in this report have been surfing on the mobile wave, demand-driven and often media-oriented (games, social media, video). This is illustrated, for example, with the extremely high number of downloaded games available from Garena, Kakao, King, Storm8, and Zynga.

In 2014, "The Conference Board" in a report to the European Commission identified two major game changers: "*the rapid diffusion of high speed networks and mobile devices empower consumers and drive demand in new ways*" (van Welsum et al, 2014: 3). Our views back this analysis. However in 2008, Commisioner Reding did stress that "Our strong EU mobile industry is however at a historical tipping point", and was already

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106 Interestingly, in the wake of this early deployment some start-ups like Buongiorno managed to devise a business model moving from mobile TV to apps.

107 Next generation access.

108 On-demand audio-visual content streamed to a mobile device.

109 According to Ericsson consumer research, quoted by GSMA Mobile Economy Europe 2014: 20

110 Neologism coined in 1980 by futurologist Alvin Toffler in anticipation of future trends

111 The iPhones already allow for some kind of motion pictures; manufacturers are introducing new cameras that may not be different from the camera they produced for the lighter professional cameras.

asking "Can today's leaders convert their leadership into an advantage for the future, or will the successes of the past create a legacy that locks it out of the Mobile Internet?". During the same presentation (at the GSMA Mobile World Congress), she noted: "Let us be quite frank: the growth of Mobile Internet so far has been disappointing in Europe". EU telecom operators, deploying 3G networks, were indeed also grappling with new business models especially to accommodate an emerging data consumption that did not fit their former voice-centric metered business model. Weber et al put the blame on an over dependency on GSM-related technologies such as SMS and MMS (2011: 3), and the subsequent lack of competition between technologies. They contrast this with the Japanese case (i-Mode) where services were launched on the basis of proprietary technologies (2011:9). It also accounts for the failure of the introduction of Wireless Application Protocol (WAP)[112], the first EU attempt to introduce a mobile equivalent to the internet, based on a common industry standard.

Assuming the above interpretation of the technological wave and its related deployments are correct, the question may turn out to be: did the EU miss the mobile turn – not only from a policy viewpoint but from an industrial and a manufacturing viewpoint? Box 12 on the Nokia case provides an illustration.

It is not within the scope of this report to investigate what might have been the causes of this apparently missed mobile opportunity in European policy and industry. However, we can assume that today's opportunities, illustrated by the unicorns, have been built and are still developing on the *mobile* internet wave and the consequent evolution of *demand*.

Box 12: NOKIA stumbles…. on a success story

The release of the Nokia Communicator in 1996 was held to mark, together with IBM's Simon in 1993, the beginning of the smartphone era. A smartphone is still a loosely-defined category of mobile telephones with extended capabilities and some PC-like functionalities.

Later, Nokia announced the Nokia 7650 (on 19 November 2001). The phone was referred to as a "smart phone" by the media. It was then released on 26 June 2002 for around EUR 600.

In 2008, when Google released the cross-platform operating system around android, Nokia bought the independent non-profit organisation Symbian Foundation and supported the deployment of the Symbian operating system, a royalty-free, open source software. Symbian was at that time the most diffused operating system for smartphones.

Unfortunately, the launch of Nokia's new device, the smartphone, was unsucessful in spite of the fact that the Finnish company was not only a global leader with strong investments in R&D, but also an acknowledged innovator with good marketing experience, and an impressive number of patents.

Nokia had not managed to deal with its new competitors. When Apple introduced the iPhone in the third quarter of 2007, Nokia's market share was still at 48.7%. By the third quarter of 2012, however, it had slipped down to just 3.5% (Statista, 2015).

Despite first class marketing, Nokia may have missed some of the elements of the then burgeoning ecosystem and the emerging business models. EU telecom operators, deploying 3G networks, were also grappling with new business models to accommodate emerging data consumption that did not fit the former voice-centric business model.

Sources: updated from C. Feijoo in De Prato et al, (2010: 16)

[112] Working under a push technology: delivery of content to the mobile device without previous user interaction (Openvawe 2002).

4.2 Direct or indirect policies?

The development of unicorns is market-led and does not appear to be the result of any specific policies. As expressed above, the unicorns in our sample appear to be the children of the third technological wave, marked by the strong surge of the mobile internet, particularly in Asia, and that of user-centric business models.

Of course, indirectly, unicorns benefit from all kinds of existing measures like tax shelter, special support for SMEs in the EU and in the US (see Forge et al, 2012). More generally, they also benefit from earlier stages of technological development and top-level clustering – e.g. the "valley" phenomenon. These factors have much to do historically with public policies, including defence (in the US at least), higher education and public research.

There has also been some focused direct support. For instance, Criteo benefited from the support of the French "Credit d'impôts recherche", a tax credit[113]. In some countries, like China, direct interventions may have played an important role, as the Chinese government has been prioritizing certain areas, with a view to building national champions. In March 2015, the Chinese government unveiled its "Internet Plus" plan with direct and indirect support for Chinese start-ups[114] Companies like Alibaba or Xiaomi may have received some kind of subsidies: for instance, low postal rates for shipping their products outside China.

Cluster policies: the Valley pays off

By and large, indirect support seems the most important: business environment, access to capital, and access to the expertise needed from universities and research centres (some of the unicorns like Akamai are spin-offs from labs). This underlines the role of clusters like Silicon Valley and other "technical hubs".

In the EU, unicorns are located or born in London, Paris or Stockholm. These cities are the leading EU ICT poles of excellence (Nepelski and De Prato, 2014a, b), also ranked in the Compass report (2015: 25) as world-class start-up ecosystems. However, the Silicon Valley ecosystem captures a substantial share of the value generated by the top 20 start-up ecosystems studied over the past years: 50% of the value went to Silicon Valley whereas London, the second ecosystem, received a little over 10%. This ranking echoes the power of the US financial system.

In the report, Compass only ranks Singapore and Bangalore (number 10 and 15 respectively in the start-up ecosystem ranking) for Asia, but this ranking suffers from an acknowledged bias.[115] In our sample, Garena comes from Singapore and Flipkart from Bangalore.

Single Market: size matters

As noted by Forge et al (2012) in their analysis of Amazon: "*The more advantageous business environment in the USA was a key factor for Amazon's successful start-up and growth in its first few years. A large, single market helped Amazon to bring economies of scale to bear on its low margin business model to establish its competitive advantage"*. Their analysis of the Amazon case is probably still valid for most of the companies in our sample.

Their analysis also highlights the fragmentation of EU markets. First, the different languages spoken in Europe force websites to provide local language ordering

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[113] The company benefited from EUR 2.4 million in 2012 (Cuny, 2013). The tax credit waives some of the social or income taxes for innovative start-ups like Criteo.

[114] Premier Li Keqiang stated: "The government needs to deepen reform to help these start-up companies survive and thrive," (quoted by Chang, 2015).

[115] The Compass report clearly indicates that Beijing, Seoul, Shanghai, Shenzhen, Taipei and Tokyo have not been analysed.

processes [116] Second, companies face an uneven playfield with regard to business environment and tax issues: "*The EU's highly variable tax and business conditions across the 27 Member States contrasts with the largely uniform situation in the USA*"[117]. What is true of US companies may also be relevant, to a certain extent, for Chinese and Indian companies. They benefit from similarities in terms of "unified" culture and also from the potential market size [118]. The Commission's Digital Single Market [119] initiative clearly targets these issues but it has yet to be seen whether efficient remedies will be provided.[120]

Emerging markets, growing middle-class

There are no unicorns from Southern or Eastern Europe listed in the Atomico list or in our initial sample[121], with the apparent exception of Allegro in Poland, a Naspers' subsidiary (South Africa!). Eastern Europe could have bet on various parameters like the growth of the mobile market, developing economies, emerging middle-classes, the emergence of high-tech start-ups. Had this happened, one could have expected a similar scenario to that of emerging markets like China or India. Russia produced a few unicorns (3 in the Atomico list) and strong mobile telecom operators like VimpelCom. The barriers that have prevented the emergence of unicorns in Eastern Europe need to be identified and could consist of lack of finance, business environment, regulation, lack of expertise, competition with western incumbents, not enough training for would-be entrepreneurs, inadequate education, etc.

The lack of unicorns in Latin America, Africa or the Middle East may be linked to the same issues. Unlike China, where a strong government policy boosts science and innovation, some of the BRICs[122] countries, for instance South Africa, have not been able to push the new areas, or even to train enough engineers. In South Africa only is 300 engineers qualify annually (Gillwald and Simon, 2012).

4.3 Regulating disruptions?

Change inevitably brings with it many disruptions, most of which probably have unintended consequences. Though a comprehensive investigation of these disruptions is beyond the scope of this report, this section gives an overview of the issues.

The question is whether digitization means positive disruption ("creative destruction") or negative disruption (job losses). It can have waterbed effects with positive impacts in some regions or sectors and negative in others. The economic impact on employment and growth has triggered hot debate,[123]which, most of the time, is caught "*between conflicting rhetorics and uncertain facts*" (Codagnone 2016)[124]. Much of the debate about the impact of disruptions suffers from the same lack of evidence. Positive spill-overs are

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116 An aspect deemed essential in the analysis by Gomez & al (2013). E., Martens B., Turlea, G., 2013

117 This is in line with what Veron (2015) writes about the major obstacles to the EU capital market integration: 'Major obstacles to capital markets integration remain untouched, including divergent accounting enforcement regimes, fragmented market infrastructure, or incompatible frameworks for the taxation of financial investments".

118 Even if both big countries have important cultural variations among regions.

119 See at: http://ec.europa.eu/priorities/digital-single-market/

120 These aspects are studies at large in the DSM series: http://is.jrc.ec.europa.eu/pages/ISG/DigEco.html

121 Hence the targeted addition of Buongiorno as a « gem" in our observations.

122 Brazil, Russia, India, China, and South Africa.

123 See some JRC-IPTS reports on the topic: Smaranda Pantea S., Biagi F., Sabadash A. (2014). Are ICT Displacing Workers? Evidence from Seven European Countries.; Falk M., Biagi F. (2015) Empirical studies on the impact of ICT usage on employment in Europe. Digital Economy Working Paper 2014/07

124 Codagnone expresses this specifically about the 'sharing economy'

difficult to track, as are reduced outputs of legacy players, or losses for local and national governments[125].

Stagecoach companies were unhappy[126] in the late 19th century, just as disrupted taxi companies are today. Legacy players will claim they are facing unfair competition from players that are not abiding by the same rules. Newcomers benefit from the asymmetries of regulation in various fields[127]. This argument has already been used by the book publishing industry against Amazon and by newspapers and other industries against Google[128]. The same debate rages between legacy telecom players (BT, DT, Orange, Telefonica,) and OTTs[129] (Amazon, Facebook, Google, Netflix…). The incumbents will always ask for regulatory rebalancing.

Kaplan and Nadler (2015: 1) note that newcomers often operate in a grey zone as regards regulations: "*they operate in interstitial areas of the law because they present new and fundamentally different issues that were not foreseen when the governing statutes and regulations were enacted*". This is not new either. It is precisely what happened in the 70s with the liberalisation of the public utility markets in the US (airlines, electricity, and telecommunications: see Box 13). Debate about the liberalisation of these utilities, like telecommunications where the incumbent benefited from the protection of a regulated monopoly, went on for decades. Therefore, it is important to keep in mind that the US regulators, although they initially protected their regulated constituents, nevertheless authorized newcomers every time they could state they were bringing a new service.

Box 13: Disruptions and liberalisation of the US utilities markets

When a start-up called Microwave Communications Inc. (MCI) opened its first service in 1963[130], it made use of a loophole[131] in the regulations (Simon, 1991: 156). The incumbent, AT&T, started manoeuvring aggressively, and lobbied strongly against this newcomer. The newcomer did not abide by the very complex telecommunications regulations, or bring universal services to rural areas. AT&T ended up being divested by a court decision in 1982[132]. A reborn, revamped AT&T is still around and is a global leader.

Cable television (CATV in the US), initially classified as a TV ancillary service by the FCC, in the early 50s also grew out of a grey zone and triggered aggressive behaviour from incumbent broadcasting companies (Simon, 1991: 280).

In the airline industry, A. Kahn, a well-known economist from Cornell University, who was chairing the agency in charge of regulating airlines, decided simply to abolish the

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125 Although, Alibaba can boast being a major contributor to the Chinese tax system The *China Daily* reported that the Zhejiang-based Internet firm had made a huge contribution to tax revenues last year, paying an average of almost RMB 30 million per day. Alibaba Group Holding became the country's highest tax-paying Internet firm after it paid RMB 10.9 billion (USD 1.76 billion) in taxes in 2015 (Salvacion, 2015).

126 Wells Fargo is still around: today it is the 4th largest US bank.

127 See the Digital Economy studies series at: http://is.jrc.ec.europa.eu/pages/ISG/DigEco.html

128 See the Media studies series about the impact of the digital shift at: http://is.jrc.ec.europa.eu/pages/ISG/MCI.html

129 OTT: over-the-top, jargon for companies in the fields of broadcasting and content delivery, OTT content means online delivery of video and audio without the Internet service provider being involved in the control or distribution of the content itself. The traffic is not managed.

130 Only approved by the FCC in 1969.

131 The 1959 "Above 890" FCC decision allowed private firms to build transmission networks using frequency "above 890" megahertz.

132 The parties reached an agreement through a "consent decree": "Modification of Final Judgment" that modified an earlier similar arrangement of 1956.

regulatory agency, the Civil Aeronautics Board (CAB)[133] in 1984, and to deregulate. He paved the way for low-cost airlines, from People Express to Southwest Airlines.

What happened then with trucking[134] deregulation is not that different from what could is happen now with cabs. In the case of telecommunications, former monopolies were circumvented by technological innovations (introduction of computing in switching, new fibre networks for transmission…). These ushered in the network of networks[135], which later enabled the Internet. However, the delaying tactics of the former incumbents managed to slow down the process for around twenty years.

Source: Adapted from Simon (1991)

Newcomers will claim they are bringing new services that were not possible or even blocked by incumbents which act as gatekeepers: Netflix[136] has used this argument against Hollywood. Newcomers have taken to producing reports to show the global positive effects of their operations. For instance, Airbnb is trying to show how the company is contributing to the local economy in its city reports (see case study, Part II of this report). Uber is striking back against legal problems (e.g., the company has been raided by the Chinese government in Beijing) by releasing report after report explaining the benefits its operations are bringing to the local economy, in order to offset the apparent losses of revenues for governments (taxes)[137].

4.4 Promoting competition and innovation?

In general, unicorns are IT-based (software mostly, but also hardware), rather young global companies that match unsatisfied demand with supply through the production – which can be scaled up - of very affordable innovative services and products. Their services and products mostly depend on the mobile internet wave, and rely on connectivity (high speed networks, mobile and fixed), new devices (smartphones, tablets, phablets…) and the opportunities these bring. They are grounded on network effects, and demand-side economies of scale and scope. They rely on a strong favourable business environment, and tend to grow organically, building on fast expanding markets (emerging economies, middle classes). They are VC dependent and the competition for funding can generate impressive (inflated?) valuations. These companies can be disruptive for other sectors and firms.

There is hot debate about the real impact of Unicorns, especially those based on the most disruptive models. Governments are reacting in various ways: siding with incumbents, backing mavericks, or simply adopting a wait-and-see approach.

From a broader angle, the question for policymakers is the one stressed recently by the US Federal Trade Commission (FTC)[138]: "*How can state and local regulators meet legitimate regulatory goals (such as protecting consumers, public health and safety) while also promoting competition and innovation?*" (FTC, 2015). This kind of balance between protection and innovation is never easy as the means to achieve legitimate

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133 A. Kahn, in an interview, told the author that the regulation was so all encompassing that he had had to regulate the size of the sandwiches distributed to passengers during flights! The agency was indeed overwhelmed by these routine tasks.

134 In 1976, the Carter administration introduced a sweeping measure to deregulate trucking.

135 From a network economics viewpoint, when switching is expensive (human operators) and transmission cheap, it makes sense to reduce the number of nodes (switching) and to deploy lines of transmission within a non-competitive, unified, centralised network (see Simon, 1991, on the « geodesic network » : p.261).

136 Another unicorn established in 1997. See "The case of Netflix (USA)" in Benghozi et al (2015: pp.76-79). Available at: http://is.jrc.ec.europa.eu/pages/ISG/EURIPIDIS/documents/JRC95536.pdf

137 Codagnone (2015:30) provides a comprehensive list of the reports released by the two companies.

138 The US « guardian angel » of consumers across all industries. The communications authority, the FCC, regulates access (net neutrality, universal service…).

regulatory goals is also evolving. The EC, in its October 2015 Single Market Communication,[139] took the view that "*innovative business models must be encouraged and welcomed into the Single Market*"[140] while at the same time it referred to the need to respect consumer rules, and tax and labour laws[141].

The FTC (2014) also suggests that: *"Regulators should differentiate between regulations that truly protect consumers and those that protect the regulated*." There are tensions between rights that are not likely to disappear, quite the opposite. Stakeholders (consumers, industry, unions…) often have conflicting goals.

In such a bumpy environment, policy choices are highly challenging. Policy makers will have a hard time weighing up all the conflicting rights and societal goals that the "*transformation of everything else*" trend is likely to trigger. Nevertheless policymakers have been grappling with these issues over the last decade. Curbing infringements or abuse of dominant position can be left to the competition authorities and courts. There may be no need to regulate ex-ante without having clearly grasped what is at stake.

As highlighted by Codagnone (2016), the economic debates are, by and large, dominated by sheer rhetoric, not evidence. Whether disrupters have harmed incumbents and reduced their outputs is unclear. The increase in consumer surplus is not easily assessed either. Policymakers will need more evidence to make the right decisions about these complex, multifaceted and fast evolving issues.

"*Governments that outlaw on-demand firms are simply handicapping the rest of their economies*" (the *Economist,* January 2015). In the short term, extending legacy protection for incumbents could make the unicorn bubble burst, as disrupters and new start-ups would be barred from entering the markets. Protecting incumbent businesses is likely to be a short-term strategy; it may not help these businesses to make the transition. The days of the stagecoach as a "technology" are long gone, but Wells Fargo as a "business" is still there,… and so is AT&T.

Source: Rob Boudon in Mangalindan (2015).

"Upgrading the Single Market: more opportunities for people and business". Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

140 Commission Vice-President Jyrki Katainen, press release.

141 "*New business models bring benefits to citizens and companies alike and help optimising the use of existing resources. However, questions arise whether existing regulations are still fit for purpose or whether new rules are needed. At the same time, we need to make sure that public policy objectives such as consumer protection are respected and tax and labour law complied with*". (EC Press release).

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Appendix 1: List of investors

The US "*usual suspects*" (Ezratty, 2014) like Accel Partners, Andresseen & Horowitz, Benchmark Capital, Kleiner Perkins Caulfield & Byers, Sequoia Capital, are all present in the sample of companies, some of them since the very start.

Table 13: The top 25 investors in US (2014), ranked by number of deals

Firm	City	# of Deals
Kleiner Perkins Caufield & Byers LLC	Menlo Park, California	110
New Enterprise Associates, Inc.	Menlo Park, California	105
Andreessen Horowitz LLC	Menlo Park, California	86
First Round Capital	Philadelphia, Pennsylvania	81
Google Ventures	Mountain View, California	66
Khosla Ventures LLC	Menlo Park, California	64
Atlas Venture	Cambridge, Massachusetts	62
Sequoia Capital	Menlo Park, California	61
True Ventures	Palo Alto, California	56
SV Angel II Q LP	San Francisco, California	55
Intel Capital Corporation	Santa Clara, California	54
Canaan Partners	Menlo Park, California	54
Bessemer Venture Partners, L.P.	Larchmont, New York	54
General Catalyst Partners LLC	Cambridge, Massachusetts	52
Accel Partners & Co., Inc.	Palo Alto, California	48
Ben Franklin Technology Partners Southeastern PA	Philadelphia, Pennsylvania	46
DreamIt Ventures	Bryn Mawr, Pennsylvania	45
Draper Fisher Jurvetson	Menlo Park, California	45
Foundation Capital	Menlo Park, California	45
Innovation Works, Inc.	Pittsburgh, Pennsylvania	44
Polaris Partners	Waltham, Massachusetts	43
500 Startups, L.P.	Mountain View, California	43
Lerer Ventures	New York, New York	42
Advanced Technology Ventures	Palo Alto, California	42
Redpoint Ventures	Menlo Park, California	42

Source: MoneyTree Report (2015) (by the National Venture Capital Association and PricewaterhouseCoopers, based on data from Thomson Reuters).

These top 25 accounted for 33% of the deals in 2014. China venture capitalists scored high with good representation on the Forbes Midas list 2015 rankings. Of the top 100 tech investors on this annual, 10 venture capitalists are based in China while another seven are in the U.S. actively doing deals in China (Fannin, R., 2015).

Table 14: The top 10 global investors[142] in last 365 days through 13 February 2014, by amount

Investor	Number of investment rounds	Amount invested (US$m)	Acquired/merged companies (as a percentage of total)	Publicly held companies (as a percentage of total)	Year founded
Kleiner Perkins Caufield & Byers	71	1,920	25%	25%	1972
Accel Partners	73	1,671	35%	14%	1983
Andreessen Horowitz	81	1,660	8%	3%	2008
Sequoia Capital	89	1,539	27%	19%	1972
Bessemer Venture Partners	53	1,440	37%	17%	1971
New Enterprise Associates	72	1,386	32%	19%	1978
Index Ventures	62	1,322	25%	6%	1992
Greylock Partners	51	1,269	39%	23%	1965
Google Ventures	80	1,160	9%	2%	2009
Institutional Venture Partners	21	1,110	38%	26%	1980

Source: EY (2014: 41)

Table 15: The top 10 investors in Asia (2015)

INVESTORS	DEALS
Sequoia Capital	111
500 Startups	57
Matrix Partners China	50
IDG Capital Partners	50
SAIF Partners	41
East Ventures	41
Tencent	31
ZhenFund	29
Accel Partners	27
Shunwei Capital	25

Source: T. Lee (2016).

It is not surprising to see the strong presence of US VCs like Sequoia, 500 Start-ups, IDG or Accel Partners.

[142] Software sector for all investors except for Index Ventures, for which it is consumer information services. Round class focus: first round for all investors except for Institutional Venture Partners, for which it is second round.

Table 16: The main investors in the sample

Investments banks and institutional investors	
China CITIC Bank: Uber, *China Life Insurance:* Uber *Fidelity:* Flipkart *Goldman Sachs:* Uber, Facebook, *Korea Investment Partners: Kakao Talk*	*Qatar Investment Authority:* Flipkart *Morgan Stanley:* Twitter, Flipkart, Zynga, *Ontario Teachers' Pension Plan:* Garena, *Ping An Insurance Group*: Uber, *Softbank:* Alibaba, Zynga, Criteo, *Temasek,:* Alibaba, Xiaomi
Venture Capital	
Acacia Capital Partners: Shazam, *Andreessen Horowitz:* Twitter, Airbnb, Zynga, *Accel Partners:* Flipkart, Facebook, *Apax:* King.com *Avalon Ventures:* Zynga, *Berjaya:* Kakao Talk *Bessemer Venture Partners:* Criteo, *Bezos Expeditions:* Uber, Twitter, *Bridger Management China:* Baidu *China Value:* Baidu *Companies Registration Office (SCRO) (EU):* Rocket Internet, *CyberAgent Ventures:* Kakao Talk *DCM:* Kakao Talk *DN Capital:* Shazam, *Draper, Fisher, Jurvetson:* Baidu *DST Global,* Flipkart, Zynga, Facebook, *Equity Partners:* Baidu *Elevation Partners:* Facebook, *Elaia Partners:* Criteo, *Emesco AB (Sweden):* Rocket Internet, *Erasmic Ventures* Flipkart*:* *European Founders Fund:* Facebook, *European Holdings (Luxembourg):* Rocket Internet, *First Round Capital* *Foundry Group:* Zynga, *Quiming Venture:* Xiaomi *Helion Ventures:* Flipkart *Horizons Ventures:* Facebook, *GIC.* Flipkart *General Catalysts Partners:* Airbnb, *GGV Capital Partners:* Alibaba, Xiaomi *Google Ventures:* Uber *Greylock Partners:* Airbnb, Flipkart, Facebook,	*Hillhouse Capital:* Uber *IDG Capital:* Baidu, Xiaomi, *Iconiq Capital Llc:* Flipkart, *Idinvest Partners:* Criteo, *Index Ventures,* King.com, Criteo, *Integrity Partners:* Baidu *Institutional Venture Partners:* Zynga, Shazam, *International Data Group Inc.* *Intervision Holdings:* Flipkart *Kleiner Perkins Caufield & Byers:* Alibaba, Amazon, Google, Twitter, Zynga, Shazam, *Lowercase Capital*: Twitter, *Maverick Capital:* Kakao Talk, *Meritech Capital Partners:* Facebook, *Morningside Ventures:* Xiaomi *Menlo Ventures:* Uber *PCCW:* Tencent, *Peninsula Capital Fund:* Baidu *PLDT Online Investments:* Rocket Internet, *Pilot Group*: Zynga, *PTE. LTD (Singapore):* Rocket Internet, *Qiming Venture Partners:* Xiaomi *Sequoia Capital:* Alibaba, Airbnb, *Square Ventures:* Zynga, *Sofina:* Flipkart *SV Angel:* Airbnb, Zynga, Facebook, *Technology Crossover Ventures* Spotify, *Tiger Global:* Flipkart, Zynga, *T.Rowe Price*: Zynga, *TriplePoint Capital*: Facebook, *Union Square Ventures:* Twitter, *United Internet Ventures AG (Germany):* Rocket Internet, *Venture TDF:* Baidu *Vulcan Capital:* Flipkart,

Manufacturers and companies	
America Movil: Shazam, *Baidu:* Uber *Google:* Baidu, Cloudera, Uber, *Qualcomm:* Xiaomi, *Microsoft:* Facebook, Uber,	*Naspers:* Tencent, Allegro, Ricardo, Flipkart (through MIH India) *Sony Music:* Spotify, *Tata*: Uber, *Tencent:* Kakao Talk, Garena, *Universal Music Group:* Spotify *Yahoo:* Alibaba.
Individuals	
S.Anderson: Twitter, *Andy Bechtolsheim:* Google, *Bill Gurley:* Uber, *Klaus Himmels*: King.com, *Reid Hoffman:* Zynga, Facebook, *Li Ka-shing:* Facebook, *Yuri Milner:* Xiaomi, *Sean Parker:* Spotify, *Greg Penner*: Baidu,	*Stuart Peterson:* Facebook, *Mark Pincus* Facebook, *Brian Pokomy:* Twitter, *Jason Port:* Twitter, *Kevin Rose:* Zynga, *Chris Sacca:* Uber, *Peter Thiel:* Zynga, Facebook, *Scott Walchek*: Baidu *Greg Yantanes:* Twitter.

The individuals listed here and indicated as investors in Crunchbase are not just "private" individuals, but well-known investors often running VCs or hedge funds who are also taking shares directly in some start-ups just like Jeff Bezos from Amazon with Bezos Expeditions. German born Peter Thiel (but US educated, Stanford University) is the co-founder of PayPal and an early investor (angel investment) in Facebook and Zynga[143]. Reid Hoffman (Stanford University) co-founded LinkedIn. To be noted Yuri Milner (Wharton School) is a Russian investor, through DST Global in Facebook, Zynga, Twitter, Flipkart, Spotify, ZocDoc, Groupon, JD.com, Planet Labs, Xiaomi, OlaCabs, Alibaba. Li Ka-shing is a well-known Hong Kong investor, CEO of Hutchison Whampoa, the owner of mobile operator Three.

[143] Originally Zynga games were distributed exclusively through Facebook (see Zynga case study).

Appendix 2: A side question: all unicorns are platforms?

Platforms: the economic, engineering and management perspectives

In September 2015, the European Commission published a questionnaire on the regulatory environment for platforms, online intermediaries, data and cloud computing and the collaborative economy. The Commission seeks comments on the following definition of online platforms: "*Online platform refers to an undertaking operating in two (or multi)-sided markets, which uses the internet to enable interactions between two or more distinct but interdependent groups of users so as to generate value for at least one of the groups. Certain platforms also qualify as intermediary service providers.*"

Gawer did some pioneering research on the topic (Gawer and Cusumano, 2002, Gawer 2014, Gawer 2015). Gawer defines platforms as "*technological building blocks (which can be technologies, products, or services) that act as a foundation on top of which an array of firms, organized in a set of interdependent firms ("ecosystems") develop a set of inter-related products, technologies and services*" (Gawer, 2009, 2015). She gives the following examples: the iPhone, the Internet, video games, and mobile phone Operating Systems.

She notes that the digital sector provides several widely recognized examples of technological platforms and their associated "platform leader" (Gawer and Cusumano, 2002), such as Google, Apple, or Facebook. Her 2014 paper aims to bridge the two dominant theoretical perspectives, the economic double-sided market (platforms as types of markets) and the engineering design perspective (platforms as specific technological architecture). Table 17 sums up the two approaches. It is an attempt to propose a unified theoretical framework for research on technological platforms but from a management science viewpoint. Gawer introduces her new theoretical framework that conceptualizes technological platforms as "*evolving organizations or meta-organizations composed of agents who can innovate and compete*".

Table 17: Platforms in economic and engineering design

Literature	Economics	Engineering Design
Conceptualization	Platforms as markets	Platforms as technological architectures
Perspective	Demand	Supply
Focus	Competition	Innovation
Value created through	Economies of scope in demand	Economies of scope in supply and innovation
Role	Coordinating device among buyers	Coordinating device among innovators
Empirical settings	ICT	Manufacturing and ICT

Source: Gawer (2015).

According to her summary, the *economic theoretical perspective* posits that platforms fundamentally create value by acting as conduits between two (or more) categories of consumers who would not have been able to connect or transact without the platform. Platforms are, in economic terms, two or multi-sided markets.

The concept of two-sided markets emerged in the 2000s as a reaction to the evolution of markets and the resulting issues faced by anti-trust researchers: dematerialization of the exchanges (Internet, E-trade), the importance of services (financial, intermediation, etc.), and the rise of the content industry/media (new business models, free newspapers, services on line, etc.). Therefore, there was a need for a new theoretical model to better understand competition between "platforms". Platforms organize/facilitate the exchanges between agents; such an activity requires taking into account: the externalities between actors of the platform, and the complementarities between products or services (Rochet and Tirole, 2003; Julien, 2011).

A two-sided market combines three elements:

1. The existence of two or more groups using the service, with different prices (asymmetric pricing).
2. The existence of crossed network externalities between these groups (a group being attracted to the platform because of the other group's participation).
3. The importance of the price-structure i.e. not only the sum paid on the whole by the two groups but also the decomposition of this sum between the two groups. One side of the market becomes an input for the other side.

The main examples of two-sided markets analysed in the literature are: dating clubs, credit cards, BtoC, BtoB intermediaries, search engines, operating systems, smartphones, newspapers, TV, video games, yellow pages and shopping malls. The Internet evolved from two-sided (search engine, directories, online press) to multi-sided markets (social networks, e-commerce, portals, news aggregators), where the content is diverse and complex.

In such markets, the price structure must be adapted to the presence of cross externalities between groups[144]. For instance, attracting a customer on one side of the market allows raising the price on the other side of the market (e.g. advertiser). The platform can thus sacrifice profit on one side to increase its profit on the other side. There is an implicit cross-subsidy between the two sides. The stronger the externality generated by a side, the lower is the price charged on this side.

The *engineering view* interprets platforms as purposefully designed technological architectures (including interfaces) that facilitate innovation. Platforms have a modular type of technological architecture, with interfaces being fundamental for modularity to facilitate innovation. The economic view is built around the economies of scope, a notion highly familiar to the economist of networks, together with the notion of economies of scale.

> *They deem that economies of scope can occur in a variety of industrial contexts (such as automotive manufacturing, aerospace engine manufacturing, consumer electronics), and a variety of organizational settings*. *This view says that the design and use of platforms helps firms achieve economies of scope in production and design – allowing for economies of scope in innovation*[145].

In her synthesis, Gawer offers a unified conceptualization of platforms, as a continuum (see Figure 14), the organizational continuum of technological platforms) as organizations where:

> *Technological platforms can be usefully seen as evolving organizations or meta-organizations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand; and (3) entail a technological architecture that is modular and composed of a core and a periphery*.

This last aspect is viewed as "*a constant throughout all kinds of platforms, and cuts across all organizational forms*."

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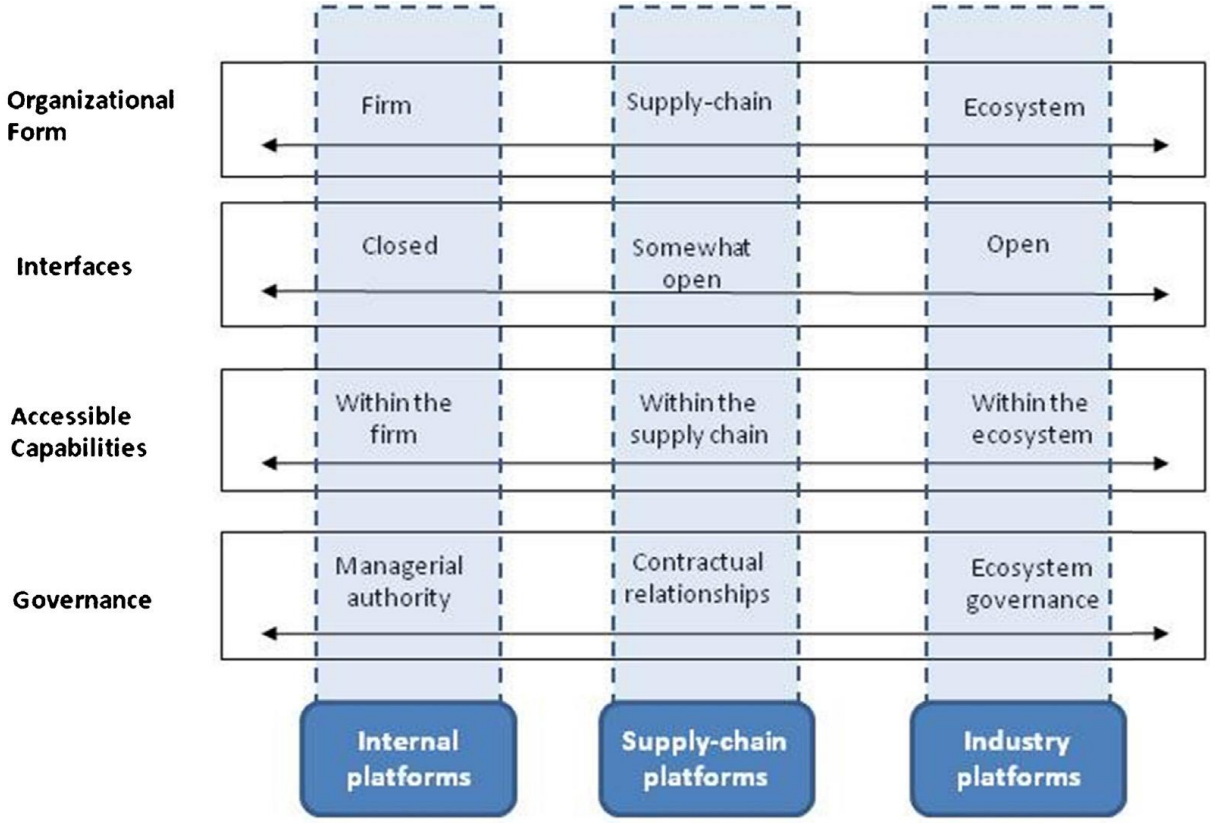
[144] Gawer, rightly, distinguishes direct network effects from indirect network effects. *Direct network effects arise when the benefit of a technology to a user depends positively on the number of other users of this technology, as for example in a telephone network, or the network of Skype users. Indirect network effects …arises if there are cross-group network effects in both directions (from A to B and from B to A) and side B's participation decision depends on the number of participants on side A so that the benefit to a user on side B depends (indirectly) on the number of users on side A*."

[145] Gowers defines economies of scope of innovation*: "innovation as when the cost of jointly innovating on Product A and B is lower than the cost of innovating on A independently of innovating on B*".

Figure 14: The organizational continuum of technological platforms



Source: Gawer (2015).

Gawer highlights the role of demand and of users taking as examples "*the case of important contemporary digital platforms such as Google or Facebook*." She stresses the interaction between users consuming the service (search, social networking) offered by these platforms while at the same time feeding the platforms with data (location, preferences, personal connections data), which in turn will be used to provide and improve the services. "*Users play therefore the role of (generally unpaid) contributors to the supply of (and further innovation on) the platform itself.*" According to her, this contributes to blurring the difference between supply or demand when users "*often play both roles (consumer, innovator) in non-separable ways*". Instead, she emphasizes "*multi-modal interaction and possibly evolving interaction between platforms' constitutive agents*".

Consumer Centricity: a common feature to Platforms and Unicorns?

The companies in our sample claim to be customer centric. For instance, Amazon's CEO, Bezos claims that they *"seek to be Earth's most customer-centric company*" (Annual Report 2014: 3).

These companies aim at bridging demand and an available resource on the supplier side. They concentrate on the customer and on their direct relationships with the customer; to do so, they use new technological resources such as Big Data analytics (De Prato and Simon, 2015).

Being customer-centric meant data for Amazon, before Google and long before Facebook and Zynga (De Prato and Simon, 2015). New forms of sales or new organisation of channels of sales (direct, indirect, flash sales, by invitation only, etc.) became possible and brought the major part of the revenues of Amazon.

Customer-centricity also means for the companies a much greater involvement of the customers in the production process. This is obviously the case with game companies like Zynga, King or Storm8 that are modifying their games according to the reactions of

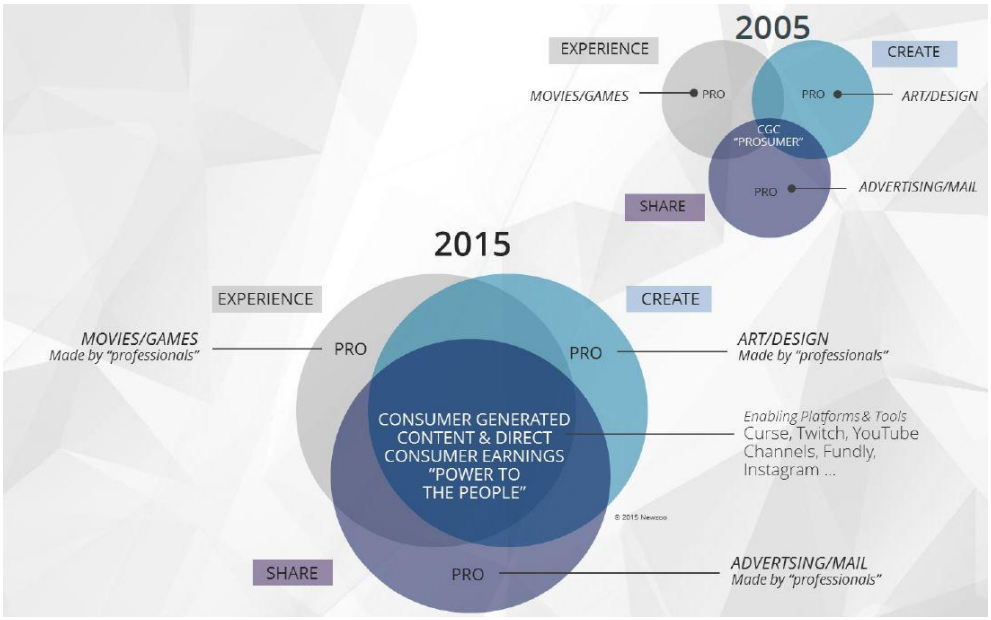
gamers. But it is even true with a manufacturing company like Xiaomi that allows users to help designing their operating system.

This interaction goes beyond what Gawer envisages about the quoted role of users. Being customer-centric also means for the companies a much greater involvement of the customers in the production process through some forms of cooperation. This cooperation can lead up to a form of co-innovation.

In recent years, consumers have become central to the video game industry: consumer have become increasingly involved in the creation, streaming, and sharing of gaming video content (Newzoo, 2015). For examples, King, Rovio (not included in our sample), and Zynga manage intricate relationships with their fans/gamers. The relationship has shifted from consumers on one side and a creator on the other side to a relationship of mutual collaboration where the consumer helps produce the game: gamers-as-producers.

Figure 15 illustrates the change in relationship between 2005 and 2015 as seen by Newzoo[146]. The consumer becomes as much as content provider as a content consumer: he/she becomes a prosumer[147].

Figure 15: Consumers in 2005 vs. prosumers in 2015



Source: Newzoo (2015: 11).

Cyanogen is another example of such business model. It is built on the idea of letting the user "customize" Cyanogen mobile device through an open software "*built by users for users*". Being demand driven rather than supply driven is a component that aims at increasing the customer willingness to adopt new services, which makes the services more scalable and increases the network effects. Such model seems also to explain the amazingly fast growth of Xiaomi and those of other new fast and nimble competitors like OnePlus.

A provisional conclusion

The synthesis offered by Gawer helps, from a management science point of view, to understand and better define the role and expansion of platforms. However, within the context of high market capital companies, the platform concept remains too broad to

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146 Newzoo is a global consultancy in games market research and intelligence. See at: http://www.newzoo.com/

147 Neologism coined in 1980 by futurologist Alvin Toffler by anticipation of future trends, a welcome result for a futurologist.

help understand any of our sampled company even when claiming to be platforms, but the wording is being used loosely. Some of the defining criteria might shed light on particular aspects. As in the case of the sharing economy, the notion stresses the participating role of consumers: *"'Users play therefore the role of (generally unpaid) contributors to the supply of (and further innovation on) the platform itself."* (Gawer, 2015). Unicorns rely on demand side economics of scale or on-demand services and therefore on the conscious and unconscious contribution if their users PPlatforms offer a market appeal because, first, they reduced transactions costs, second, they created a market that was not there before, and third, they become trusted third parties (Ure, 2015: 34):

- The transaction costs involved in marketing these assets are reduced by creating a centralised, easily accessible online marketplace.
- The creation not just a marketplace but also a market, by opening up alternative options, such as taxis at peak periods when they are difficult to find.
- As trusted third parties if they can introduce guarantees of service quality, service delivery, safe payment processes, insurance against risk, and so on. "This builds their markets in terms of scale (more users) and scope (more categories of services)".

These companies rely on network economics and scale.

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