

Digital Infrastructure in the Netherlands

Driver for the Online Ecosystem



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Executive summary and key message: the Digital Infrastructure, our third mainport, is a driver of the rapidly expanding Online Services sector

In Europe, the Dutch are among the frontrunners in the area of Digital Infrastructure (Internet connectivity, colocation housing and hosting). In many ways this infrastructure fulfills a gateway function, similar to that of Schiphol Airport and the Rotterdam Harbor. While we all have an idea on how the latter impact our economy, much less is known about the impact of Digital Infrastructure on the Dutch economy. In this report we argue that the Digital Infrastructure, despite its modest size, is a driver of the much larger and rapidly expanding Internet economy, impacting the fortunes of future economic growth in the Netherlands.

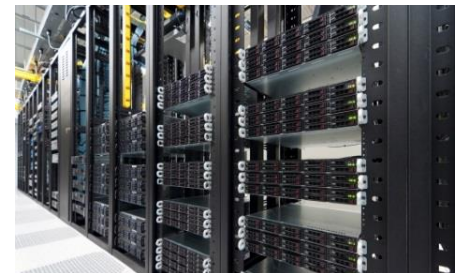
Growth and developments in the sector

In 2013 we already concluded that the Dutch have a world class Digital Infrastructure. This year we see that the importance of this sector - inhabited by Internet exchange points, and many housing and hosting parties - is on the rise. Amsterdam based AMS-IX remains the largest Internet exchange point in the world and the colocation housing market, centered around Amsterdam, produces strong growth rates. The Dutch also rank among Europe's elite in hosting.

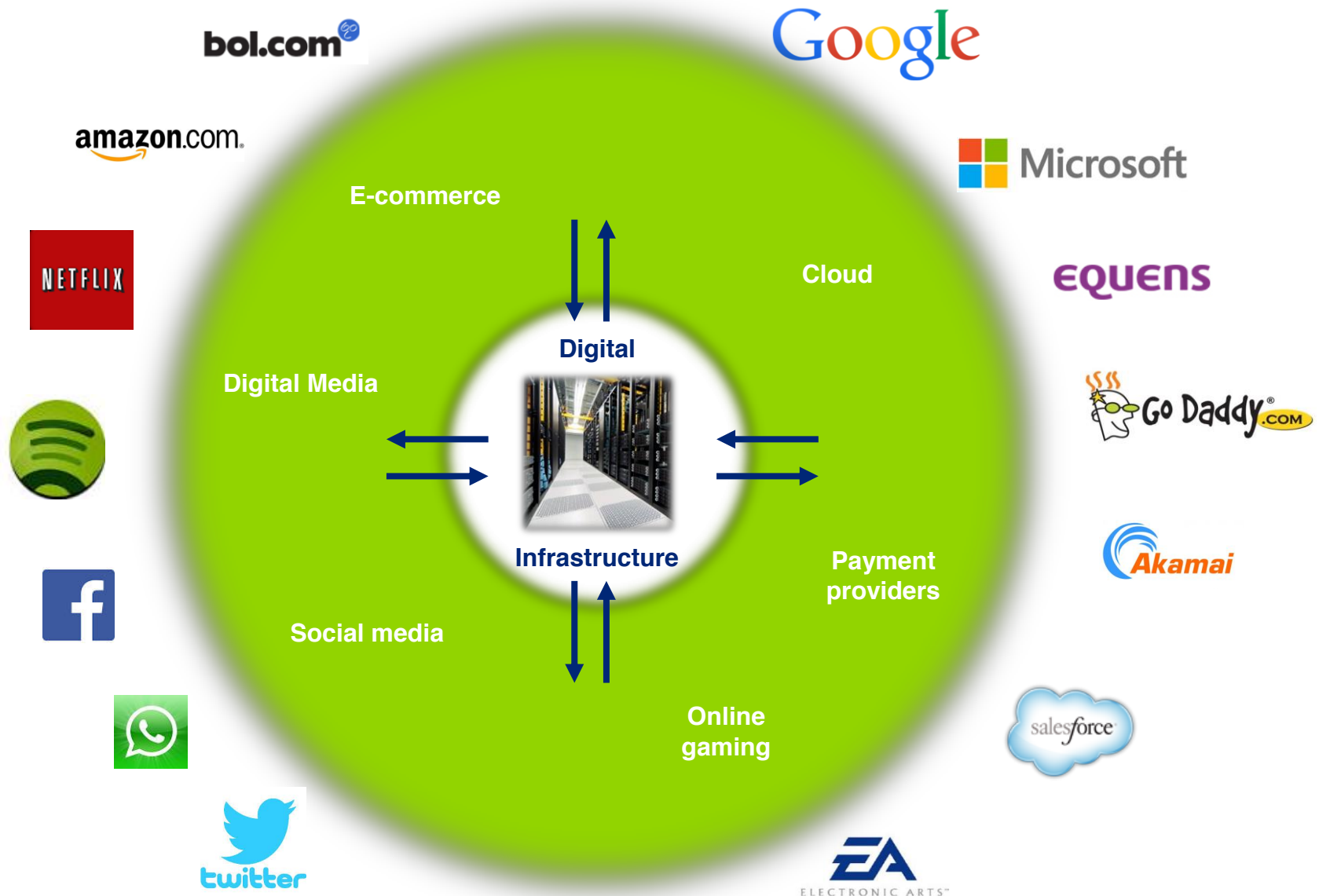
Significance for the Dutch economy

The high ranking of the Netherlands Digital Infrastructure is an interesting observation, but how do we benefit from it? Our research shows that the direct economic impact of the sector itself in terms of employment, and the indirect effects of the sector on e.g. suppliers, construction companies and workforce spending, is limited related to our total GDP.

The real value of the Digital Infrastructure sector, however, lies in its significant impact on the much larger Internet economy and broader digital society. The picture emerges that Digital Infrastructure cannot be separated from a successful digital society, placing the Dutch in a favorable position to profit from digital growth.



The Dutch Digital Infrastructure is part of a global backbone for delivering digital services to enterprises and consumers on a variety of devices



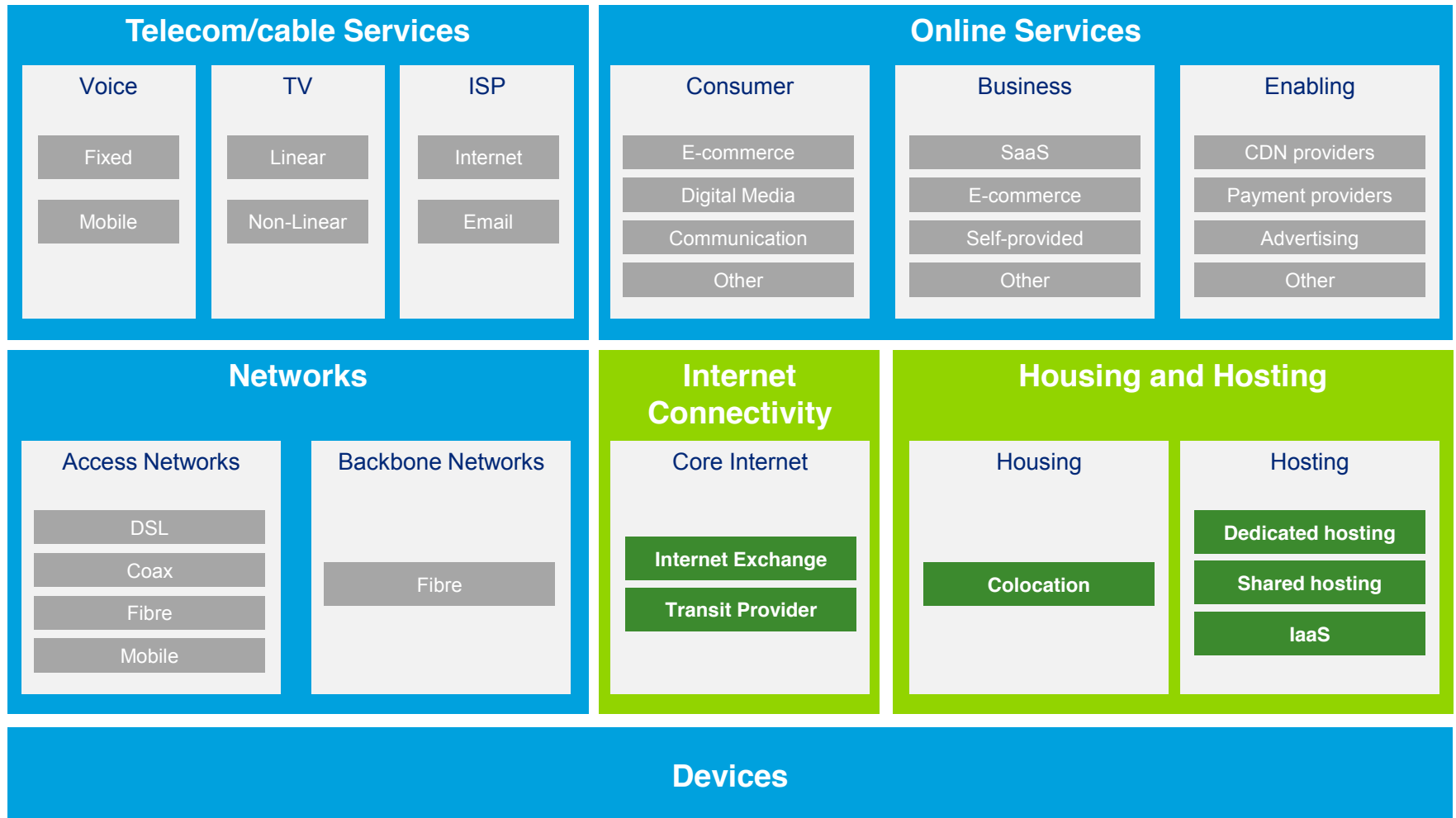


2. Digital Infrastructure sector overview

- Products and services
- Supplier ecosystem
- Size and growth
- International ranking
- Attractiveness and strengths

Digital Infrastructure products, services and supplier ecosystem

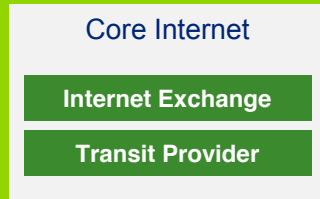
Together with Networks, the Digital Infrastructure consists of Internet connectivity and housing & hosting and is part of the larger online ecosystem



Sources: Dutch Ministry of Economic Affairs Report; A.T. Kearney Report; Deloitte analysis

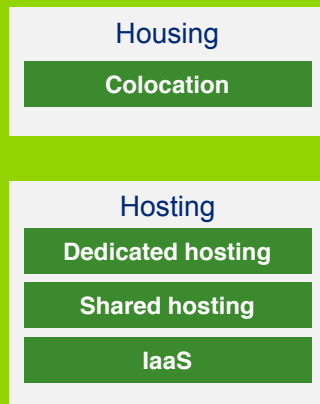
Services encompass core Internet on one hand and colocation, hosting and IaaS on the other hand

Internet Connectivity



- **Internet Exchange:** Parties that facilitate networks to interconnect with each other to exchange Internet traffic mutually (peering). This is typically done without charging for the traffic
- **Transit Provider:** Parties that provide network traffic in the 'core' Internet and connect smaller Internet service providers (ISPs) to the larger Internet

Housing and Hosting



- **Colocation:** Delivering facilities (floor space, power, cooling, network connectivity) to enterprises and service providers for housing servers, storage and other computer equipment as an alternative for an in-company data centre
- **Dedicated hosting:** Delivering computing power and storage via equipment dedicated to a specific client but managed by the hosting provider
- **Shared hosting:** Delivering computing power and storage by sharing the resources of physical equipment among multiple customers
- **IaaS:** Infrastructure-as-a-Service, delivering computing resources (e.g. servers, storage) according to a model that meets the essential characteristics of Cloud computing: on-demand self-service by the customer, measured service (pay-per-use), rapid elasticity (any quantity at any time), resource pooling (multi-tenant model) and broad network access (infrastructure is available over the network via standardised mechanisms)¹

1: The NIST Definition of Cloud computing

The colocation market is a mix of global and local colocation providers

Global Players			Local Player Colocation
Wholesale Colocation	Retail Colocation	Carrier Biased Colocation	
<ul style="list-style-type: none"> Long term lease of large scale data centre space at commodity rates Typically limited to floor space, power and cooling, the client is responsible for everything else Clients are large scale users such as banks, government departments, multinationals and IT service providers Wholesale capacity can be repackaged as retail colocation 	<ul style="list-style-type: none"> Contracts for provisioning of floor space and all facilities (power, cooling, network connectivity) Network neutral offer access to multiple network carriers Varies from multiple racks (caged) to slots in racks Beneficial for companies that do not want to make the capital investment in in-house data centres 	<ul style="list-style-type: none"> Colocation services provided by network service providers as an extension to their networking service Limited connectivity options as providers will push their on connectivity solutions 	<ul style="list-style-type: none"> Colocation services limited to one country or geographical area Often operates multiple data centres spread over the country to offer local presence (close to the customers) Suited for companies who do not need global presence in data centres at the major hot spots in the world (East coast, West coast, Europe, Asia)



The hosting and infrastructure cloud market is fragmented with many small players and larger international players

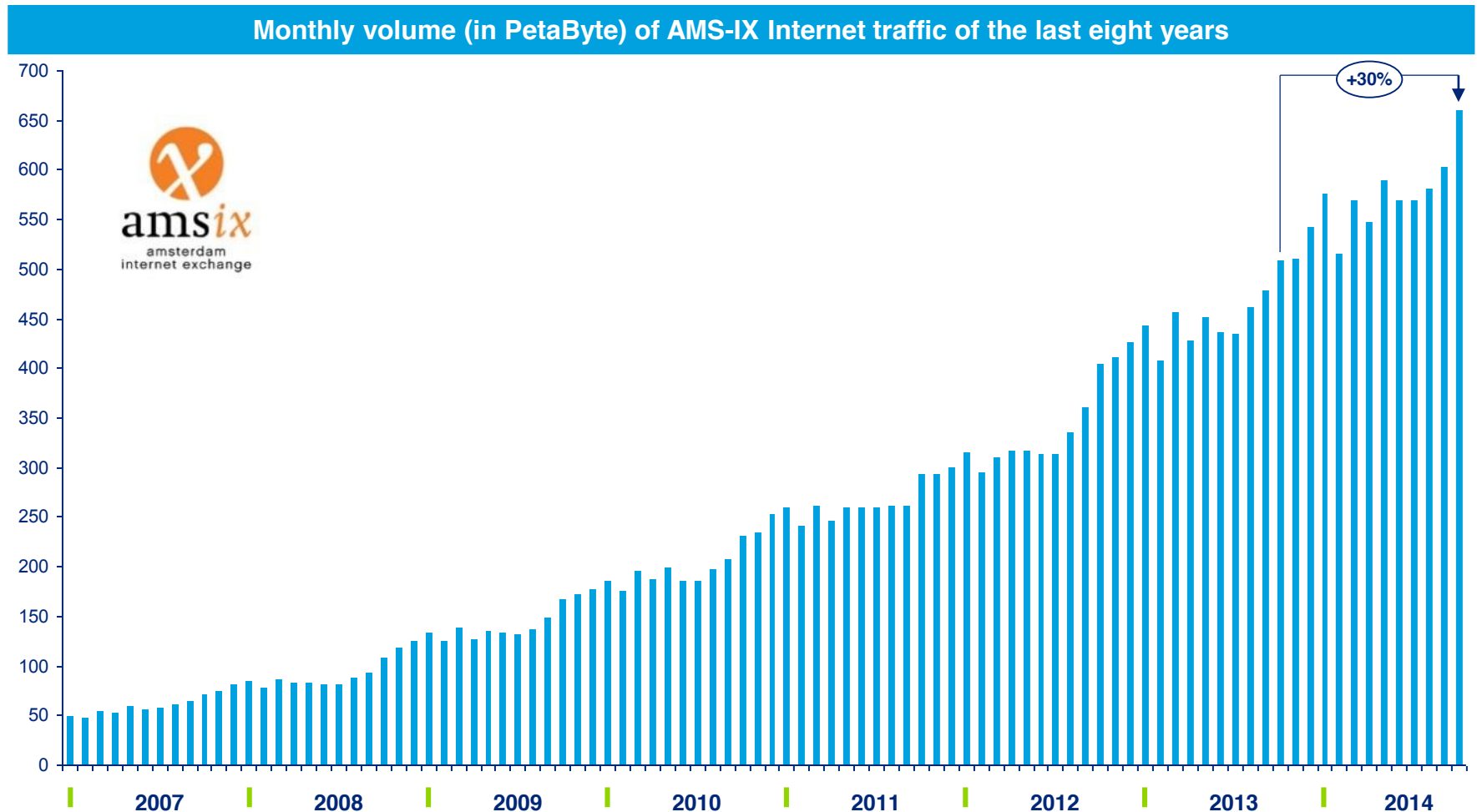
Infrastructure cloud giants	Enterprise hosters	Mass market hosters	Small local players
<ul style="list-style-type: none">• Large international players• Offering infrastructure as a service, with storage and servers on-demand• Standardized offer	<ul style="list-style-type: none">• Aiming at larger enterprises• Large contracts and specific needs• Often in combination with transformation and integration services	<ul style="list-style-type: none">• Standardized portfolio of hosting services• Aiming at small and medium businesses• Large scale with international activities	<ul style="list-style-type: none">• Small companies• Originating from web hosting and Internet access• Evolved into shared and dedicated hosting and cloud• Ability to provide local and personalized service



Many

Size, growth and international ranking of the NL Digital Infrastructure sector

AMS-IX Internet traffic has increased 13-fold in the past eight year, with 30% growth over the past 12 months

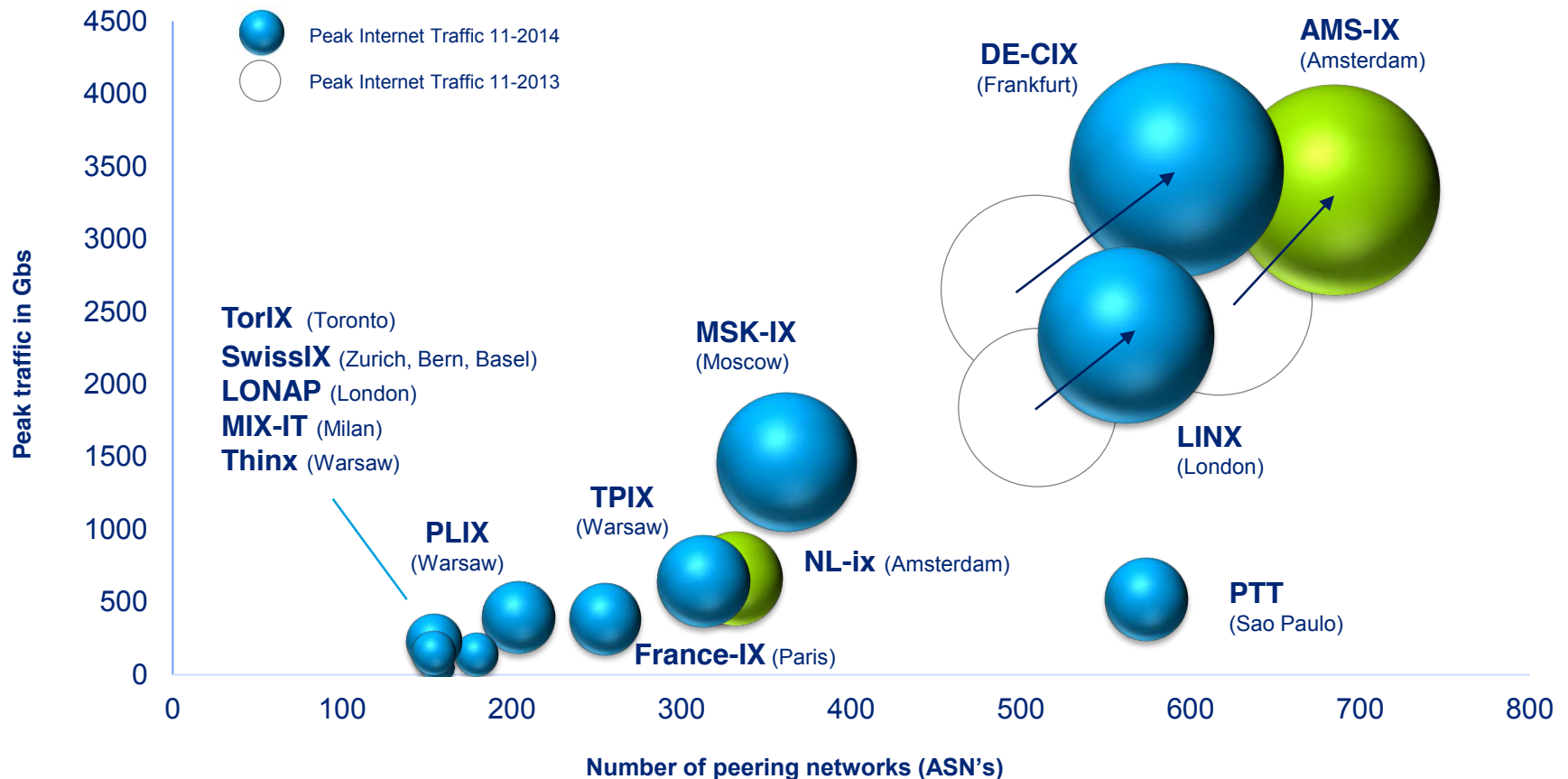


Source: AMS-IX website

The Amsterdam Internet Exchange (AMS-IX) is the largest in terms of connected Autonomous System Numbers (ASN)

Core Internet
Internet Access
Colocation
Hosting

The significance of an Internet Exchange is measured by (a) the number of peering networks (Autonomous System Numbers) and (b) the Peak Internet traffic in Gigabit per second. The graph shows these two metrics for the largest IXP's in the world.



Note: The IXP's from Equinix (Zurich), Terremark (Miami) are not listed since traffic is not known

Sources: EURO-IX website; IXP websites

AMS-IX is a mainport for Internet traffic more than Rotterdam and Schiphol are for containers and passengers respectively

Core Internet
Internet Access
Colocation
Hosting

Rank	Top Internet exchanges (by number of peering networks, '14)	Rank '13	Top container ports (by volume, '13)	Rank '12	Top airports (by passengers, '14)	Rank '13
1	AMS-IX, Amsterdam, NL	1	Shanghai, CN	1	Atlanta GA, US (ATT)	1
2	DE-CIX, Frankfurt, DE	2	Singapore, SG	2	Beijing, CN (PEK)	2
3	PTT, Sao Paulo, BR	4	Shenzhen, CN	4	London, GB (LHR)	3
4	LINX, London, UK	3	Hong Kong, CN	3	Los Angeles CA, US (LAX)	6
5	MSK-IX, Moscow, RU	5	Busan, KR	5	Tokyo, JP (HND)	4
6	NL-IX, Amsterdam, NL	6	Ningbo, CN	6	Chicago IL, US (ORD)	5
7	TPIX, Warsaw, PL	-	Qingdao, CN	8	Dubai, AE (DXB)	7
8	Terremark, Miami, US	7	Guangzhou, CN	7	Dallas/Fort Worth TX, US (DFW)	9
9	France-IX, Paris, FR	13	Dubai, AE	9	Paris, FR (CDG)	8
10	PLIX, Warsaw, PL	8	Tianjin, CN	11	Hong Kong, HK (HKG)	11
11	Equinix, Zurich, CH	9	Rotterdam, NL	10	Frankfurt, DE (FRA)	12
12	TorIX, Toronto, CA	-	Dalian, CN	20	Jakarta, ID (CGK)	10
13	SwissIX, Zurich, CH	11	Port Kelang, MY	13	Istanbul, TR (IST)	18
14	LONAP, London, UK	14	Kaohsiung, TW	12	Guangzhou, CN (CAN)	16
15	MIX-IT, Milan, IT	15	Hamburg, DE	14	Singapore, SG (SIN)	13
16	Thinx, Warsaw, PL	10	Antwerp, BE	15	Amsterdam, NL (AMS)	14

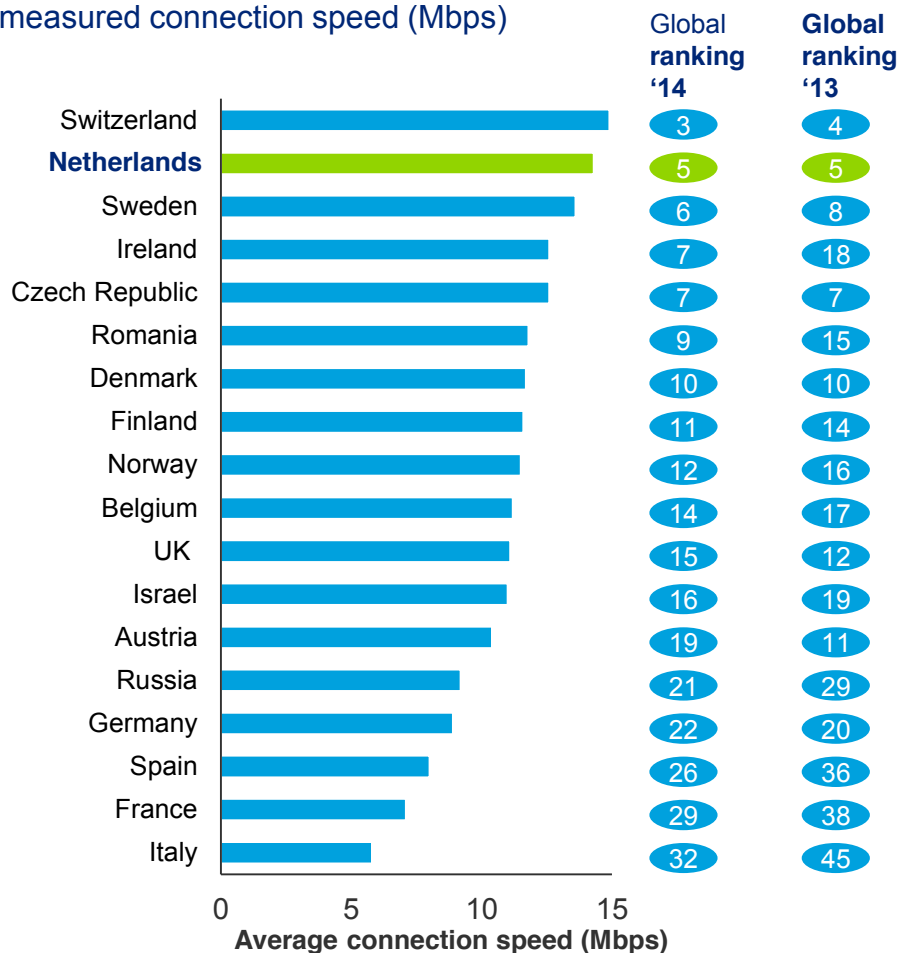
Sources: Euro-IX website; World Shipping Council website; Airports Council International website

NL scores high on average measured connection speed and broadband penetration

Core Internet
Internet Access
Colocation
Hosting

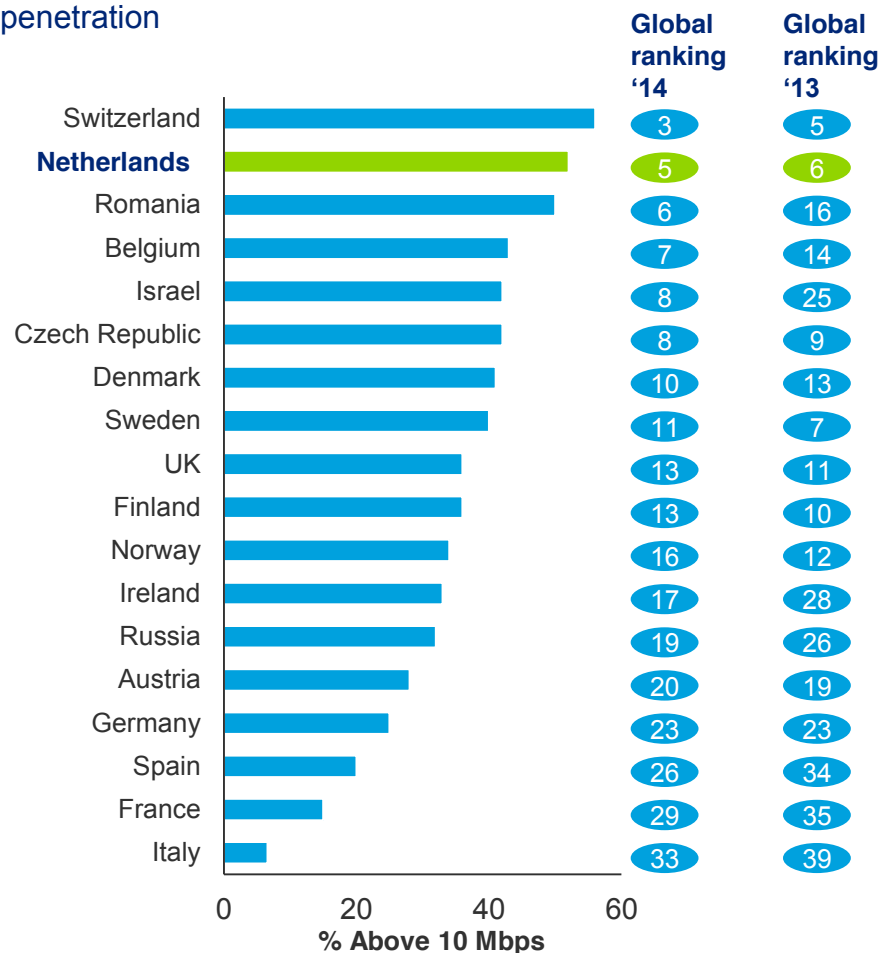
High average measured connection speed

Netherlands ranked 2nd EMEA country in average measured connection speed (Mbps)



High broadband penetration (>10 Mbps)

Netherlands ranked 2nd EMEA country in high broadband penetration



Source: Akamai Report

The Amsterdam region is part of a leading group of tier-1 data centres and shows strong increase in supply

Core Internet
Internet Access
Colocation
Hosting

Region	Supply m ²	Availability m ²	Increase last year	Supply m ² per € bn GDP
London	298	52	7.2%	138.9
Frankfurt	159	22	3.9%	56.2
Paris	111	14	4.7%	52.9
Amsterdam	101	16	6.3%	168.3

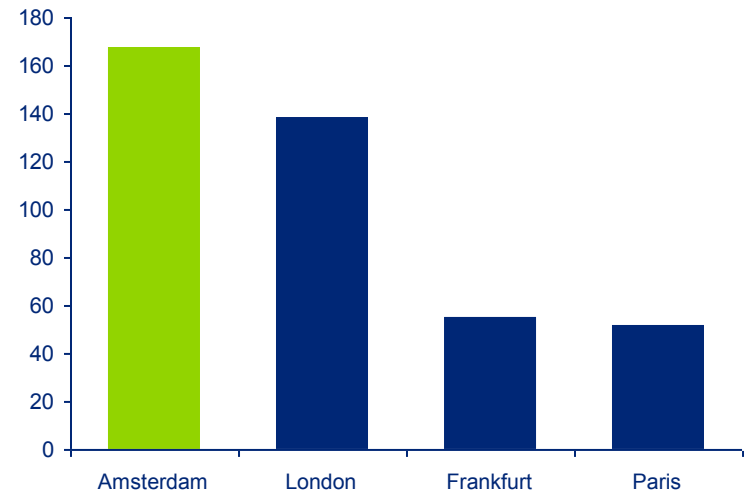
- London, Frankfurt, Paris and Amsterdam form the leading group of colocation data centres hot spots in Europe. There is a large distance between this leading group of four and the runner up on position 5 (Madrid)
- Measured in colocation supply m² per € bn GDP, Amsterdam exceeds all other cities
- Amsterdam has shown a strong increase in the past year, smaller than London but larger than Frankfurt and Paris

European Tier-1 data centres overview



Sources: CBRE Report; TeleGeography Report

Colocation supply m² per € bn GDP



This position is the result of the combination of several criteria for data centre location decisions

Core Internet

Internet Access

Colocation

Hosting

Internet Connectivity

1. Extremely well connected to the core Internet (terrestrial & submarine cables)
 - a) Lowest latency to other major Internet hubs
 - b) Large available bandwidth
2. Presence of all major carriers and AMS-IX

Energy

3. Availability of required electricity capacity (production & distribution)
4. Reliable power supply
5. Favourable electricity prices (compared to EU average)

Geographical location

6. Good accessibility (Schiphol), central location in Europe
7. Small country with a neutral position

Political and economical climate

8. Economic and political stability
9. Highly-educated and multilingual workforce
10. Focus on international trade
11. Favourable laws and regulations
12. Favourable tax climate

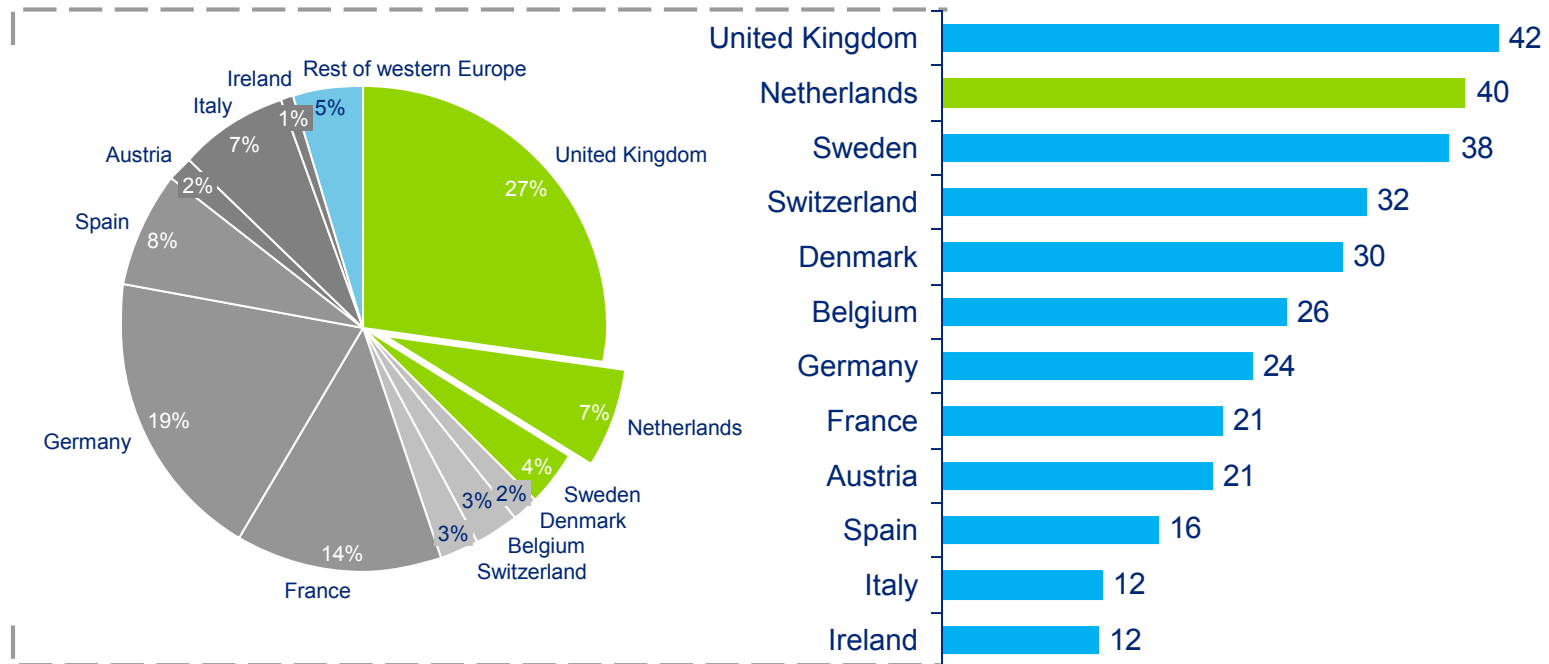
- The market for data centres is characterised by a combination of large global players (e.g. Telecity, Equinix) and many smaller local providers
- The presence of most major global data centre providers in the Netherlands is proof of the country's attractiveness
- This attractiveness of the Netherlands (and the Amsterdam region in particular) is a combination of several causes of which the most significant are listed on the left

NL holds a strong position in hosting, ranking 2nd in relative market share and spending per capita

Core Internet
Internet Access
Colocation
Hosting

Share of Western Europe's €10 bn hosting market ('13)

Hosting revenue per capita (€) ('13)



Colors in the pie chart indicate whether or not a country is below or above its fair market share (hosting share relative to GDP share in Western Europe). After UK, NL ranks 2nd, 44% above its fair market share of 4.6% (= equal to share of GDP)

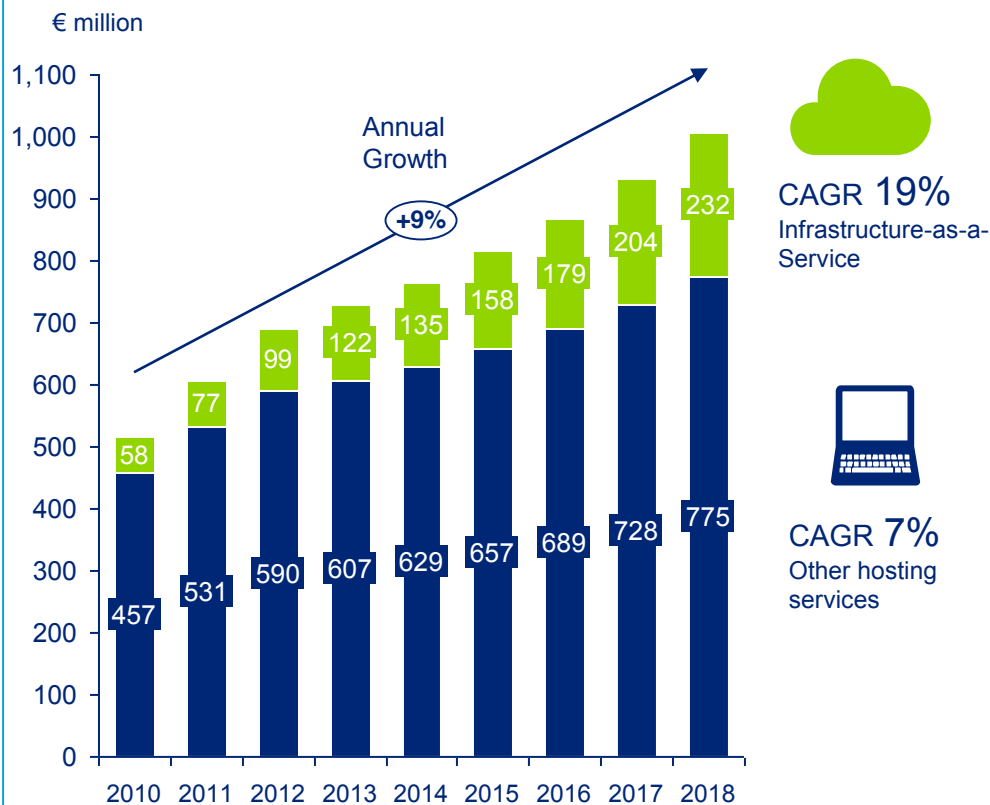


Note: GDP, hosting revenues per capita and market shares are adjusted for purchasing power
Sources: Gartner IT Services Report; Eurostat Database; Akamai Report; Deloitte analysis

The global cloud and hosting market has an average growth rate of 9% a year, with IaaS 19% growth rate being a main driver

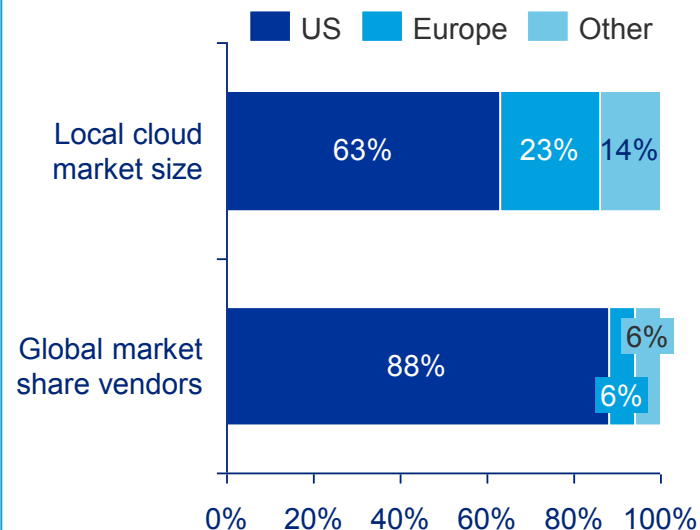
Core Internet
Internet Access
Colocation
Hosting

Growth in the hosting and cloud market



The US versus European landscape

The global cloud market today is dominated by the US, according to 451 Research (2012). The US accounts for 63% of global cloud revenues, while Europe accounts for just 23%; and only 6% of cloud vendors are European, compared with 88% from the US.

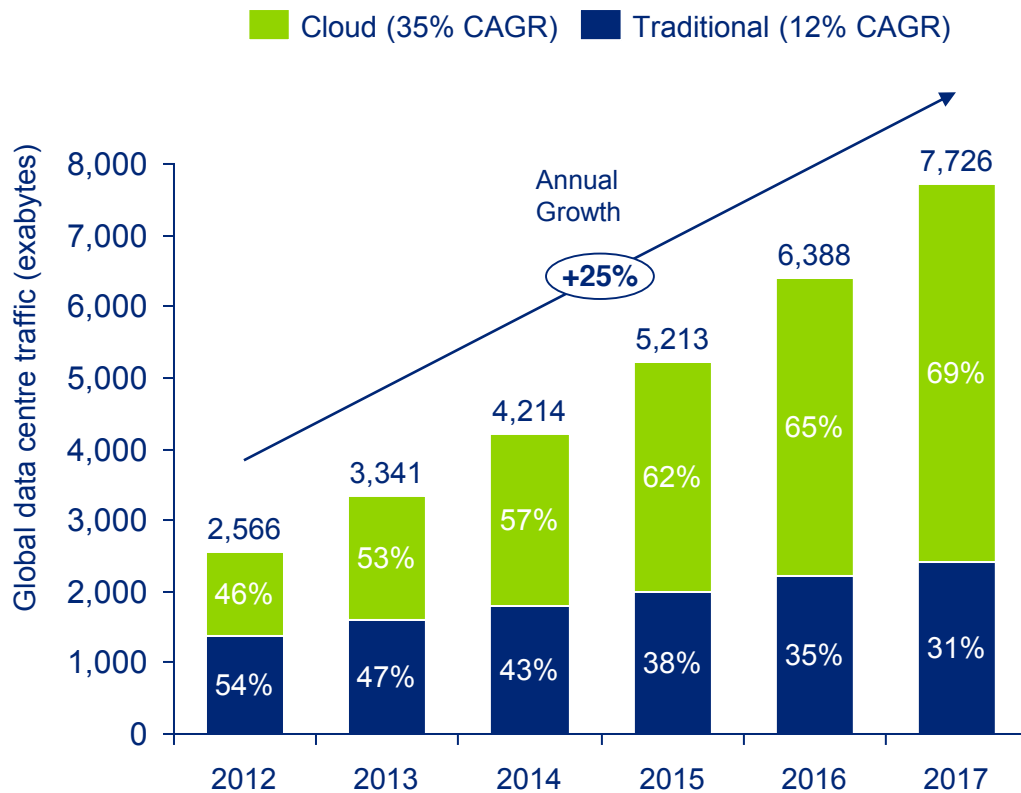


Sources: Gartner Public Cloud Report; InterXion Report; 451 Research report; Deloitte analysis

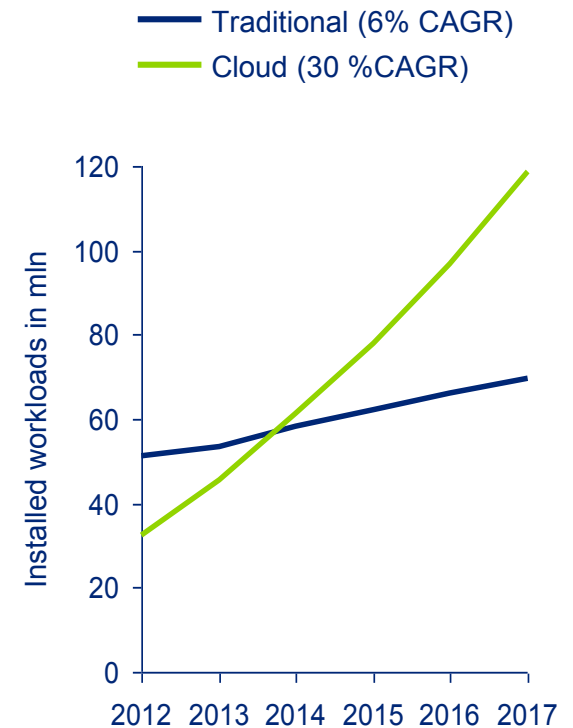
Greater virtualization drives data centre use away from traditional activities towards cloud services

Core Internet
Internet Access
Colocation
Hosting

Global data centre traffic driven by cloud



Workloads shift to cloud



Note: data on cloud services includes IaaS, as well as SaaS and PaaS

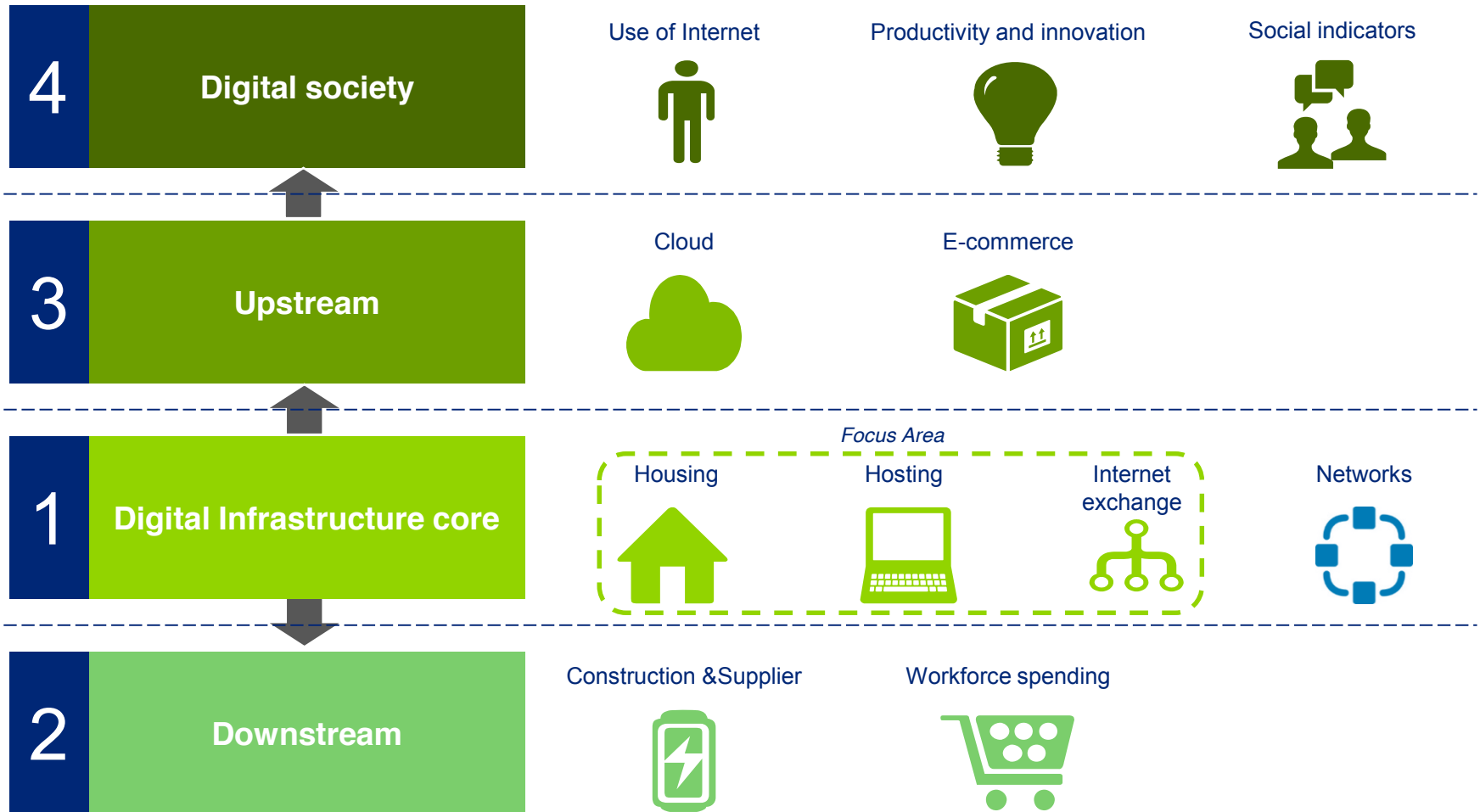
Source: Cisco Report



3. **Significance of the Digital Infrastructure sector for the Dutch economy**

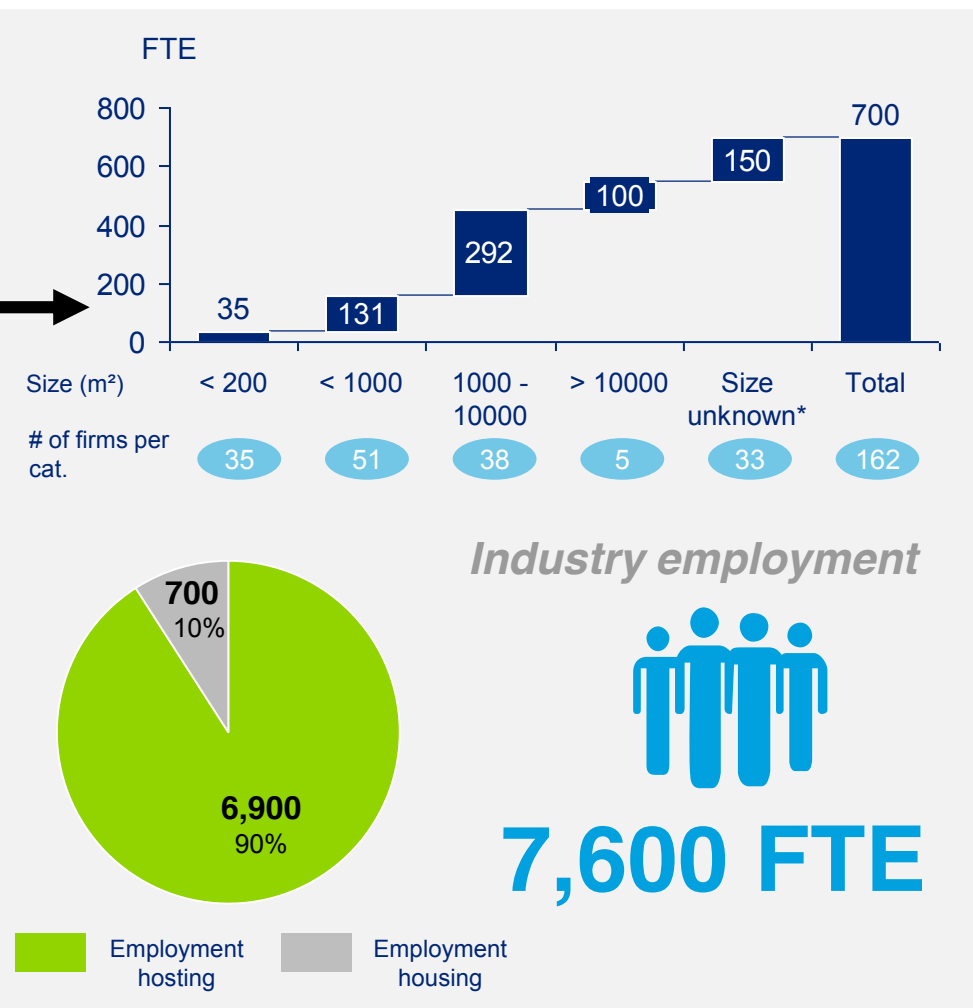
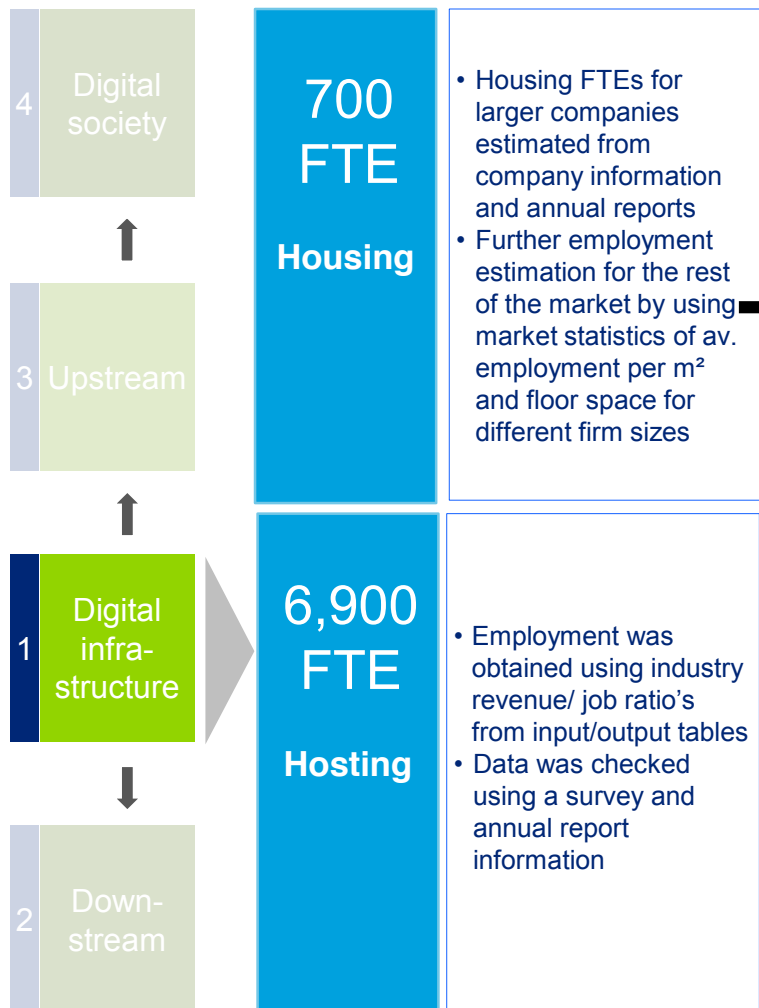
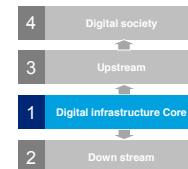
- Core contribution
- Downstream contribution
- Upstream contribution
- Contribution to the digital society

The contribution of the Digital Infrastructure sector is a combination of four effects: Core, Downstream, Upstream and Digital society



1. Core effect: employment in the Digital Infrastructure sector

Direct employment in the Digital Infrastructure sector adds up to 7,600 FTE, of which 90% in the hosting sector and 10% in capital intensive housing

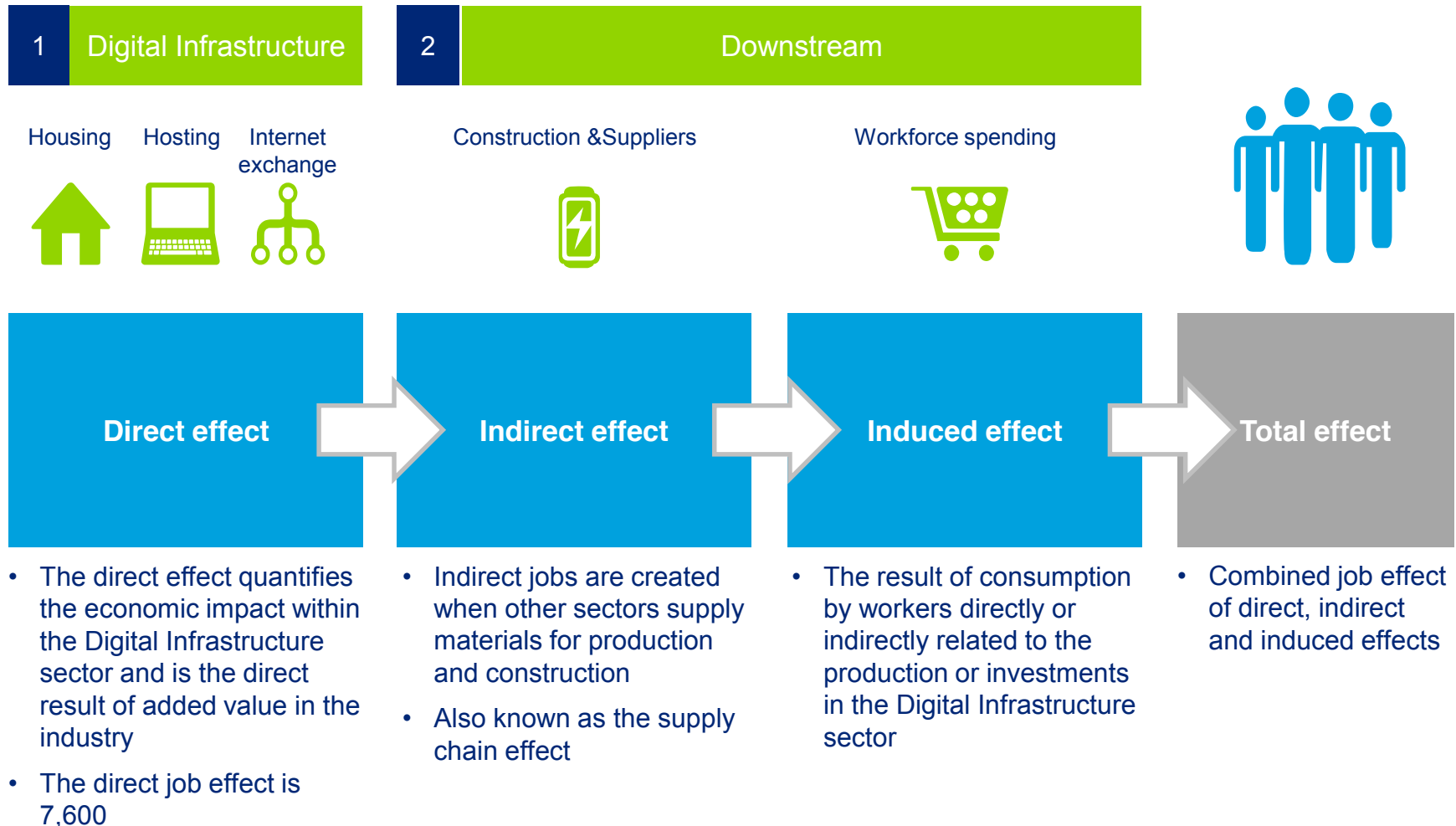
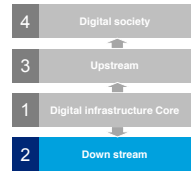


Note: numbers are based on 2013

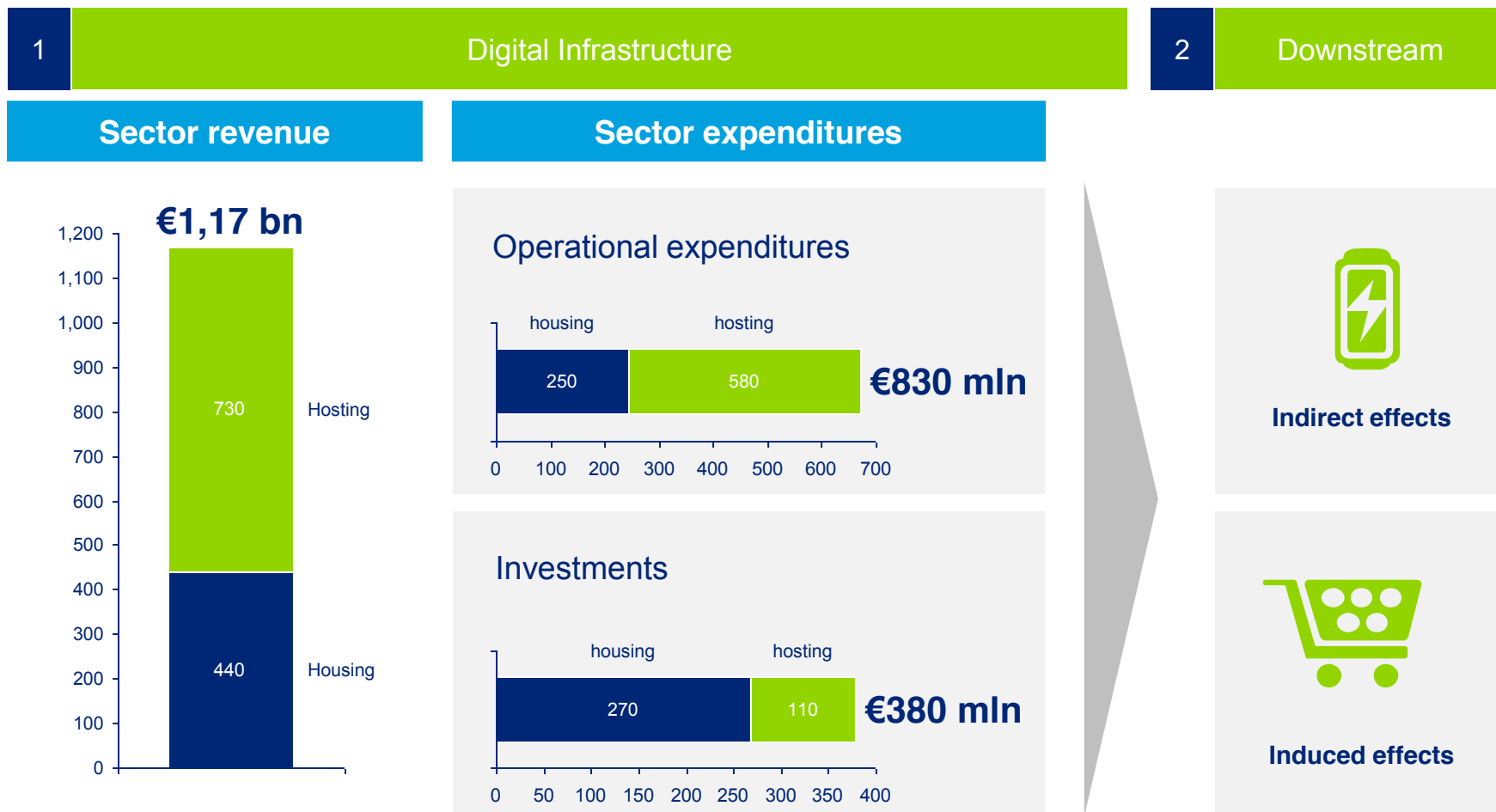
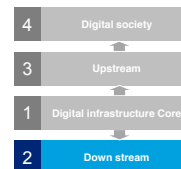
Sources: Annual reports; Datacentrum Gids website; Gartner IT Services Report; CBS database; Deloitte analysis

2. Downstream effect

To quantify the economic impact of the housing and hosting industries on the Dutch economy we make use of an input/output analysis



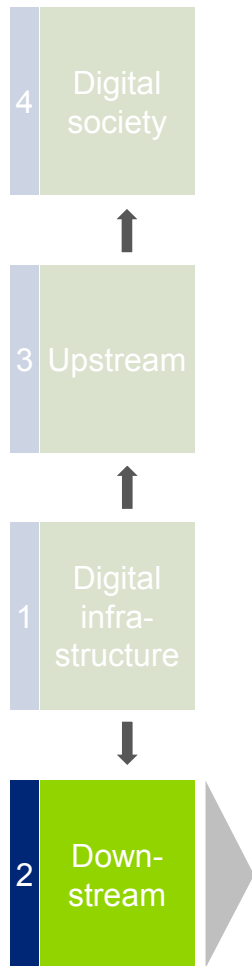
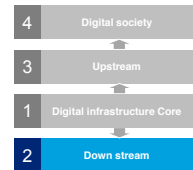
Operational expenditures and investments in the housing and hosting sectors drive indirect and induced effects to create additional jobs







Note: operational expenditures include inputs for production and wages

Sources: Annual reports; Datacentrum Gids website; Gartner IT Services Report; CBS Database; BCG Digital Infrastructure Report; Megabyte Report; Deloitte analysis

The indirect and induced effect of the Digital Infrastructure sector add up to an employment of 11,700 FTE



Indirect effect		Induced effect	
Employment from operational expenditures			
Supplier		Workforce spending	
	→		
4,000 FTE		5,700 FTE	
Employment from investments			
Construction & Suppliers		Workforce spending	
	→		
1,200 FTE		800 FTE	

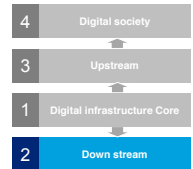
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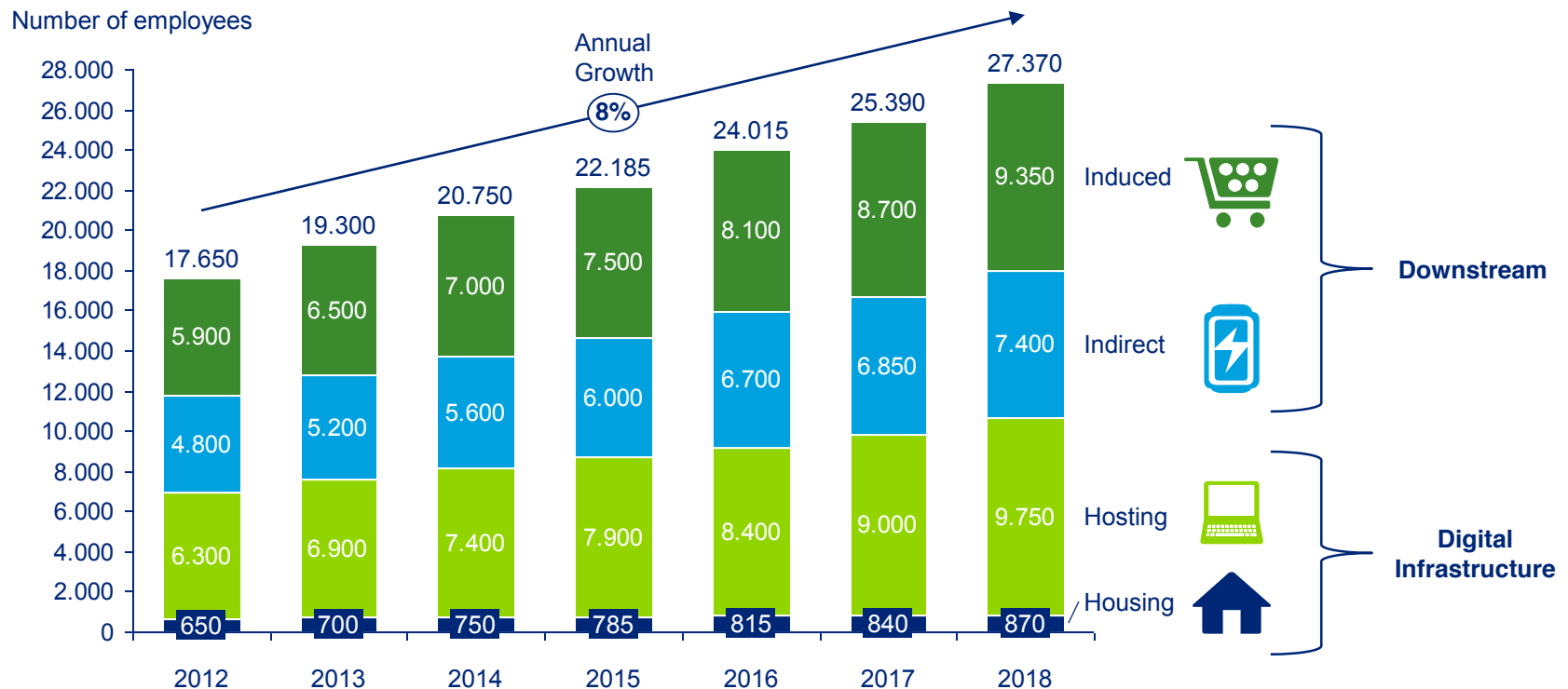
**11,700
FTE**

Sources: CBS Database; Deloitte analysis

Combined effects for the Digital Infrastructure add up to 19,000 jobs in 2013 with a projected growth of 8% a year



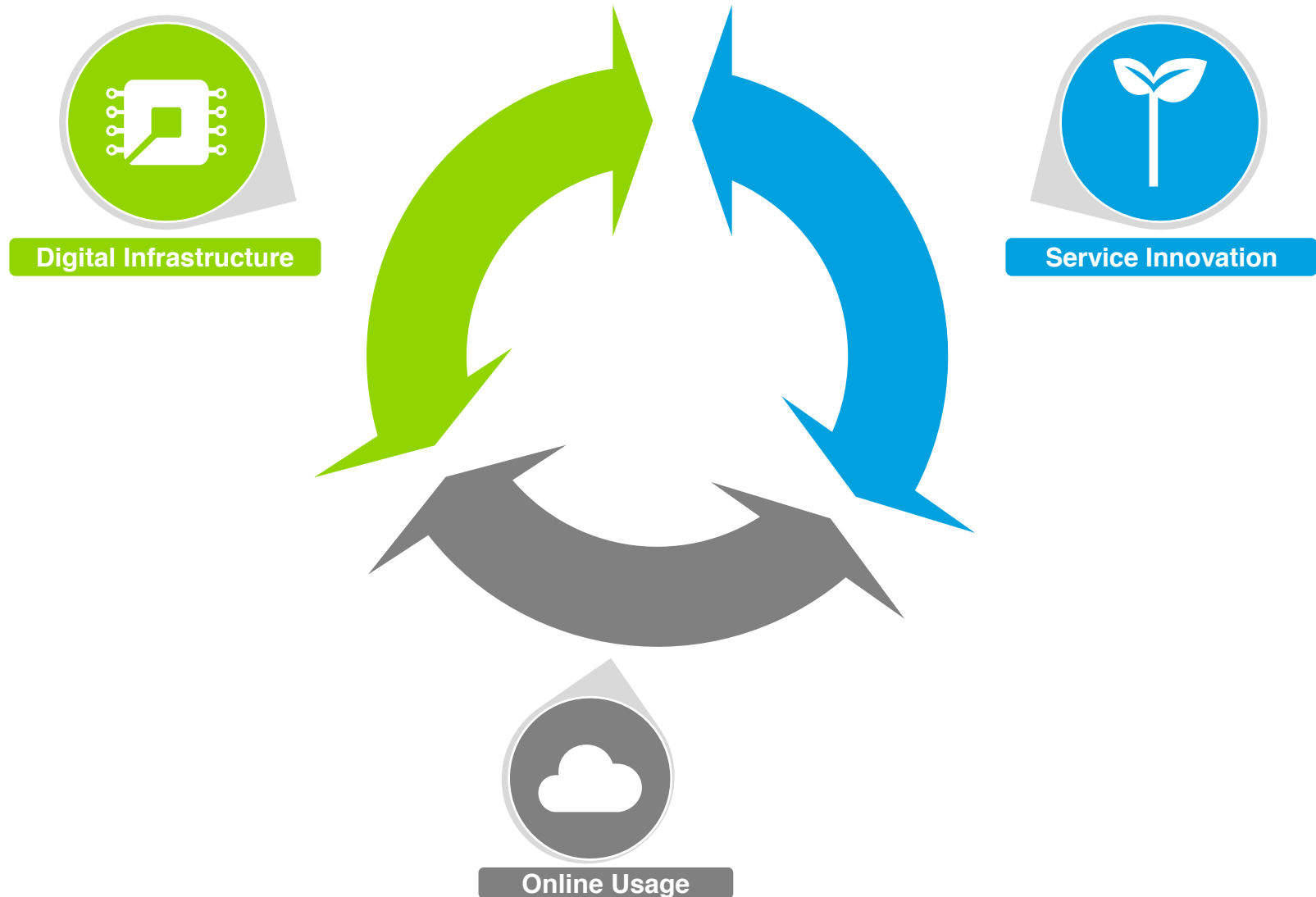
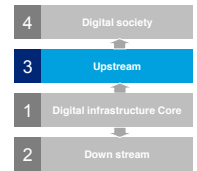
Core & downstream employment growth from hosting and housing



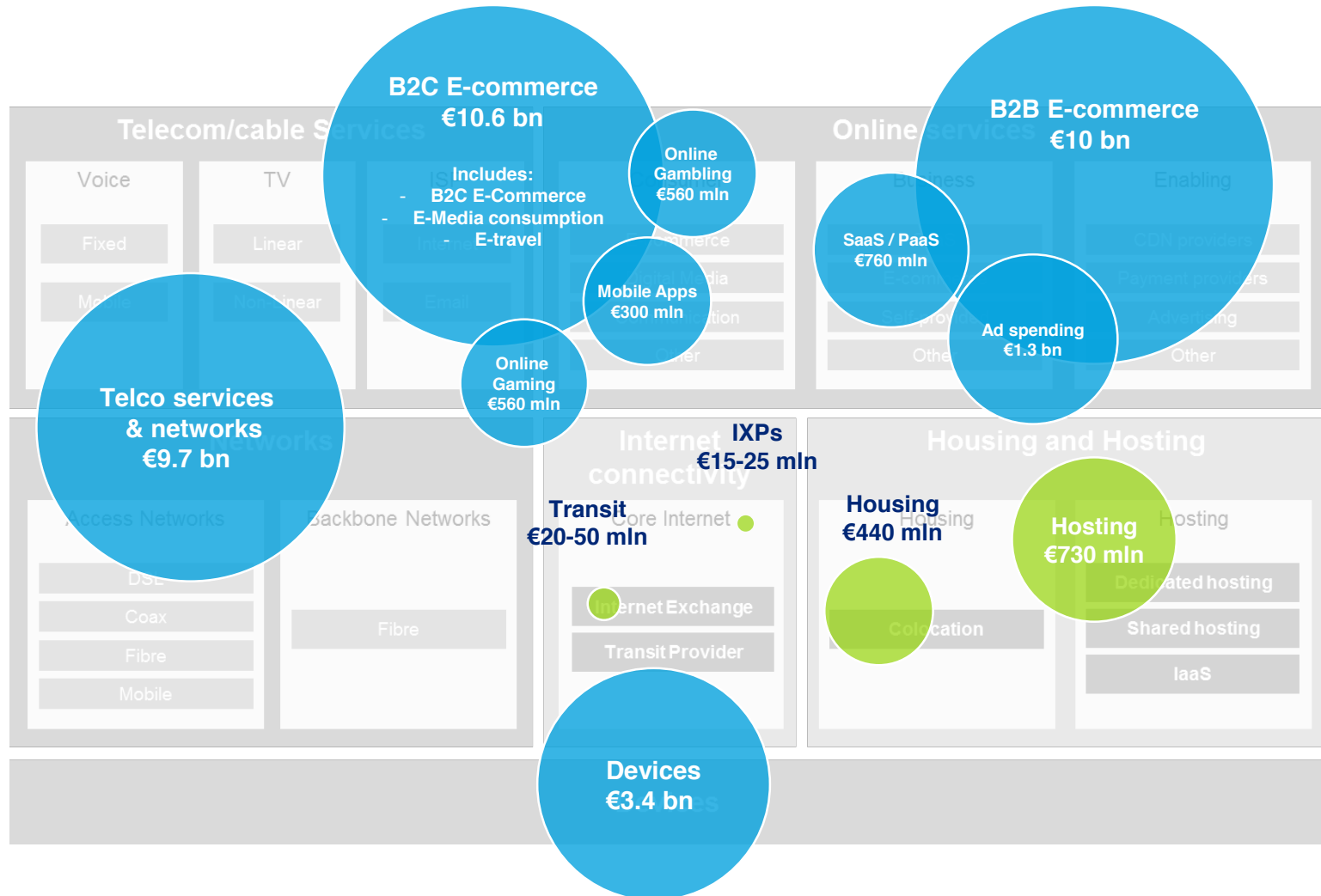
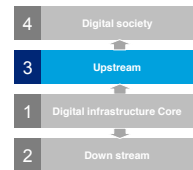
Sources: Gartner IT Services Report; CBS Database; Deloitte analysis

3. Upstream effect, contribution to the wider Internet value chain

A continues interaction between Digital Infrastructure, service innovation and online usage drives growth in the online ecosystem

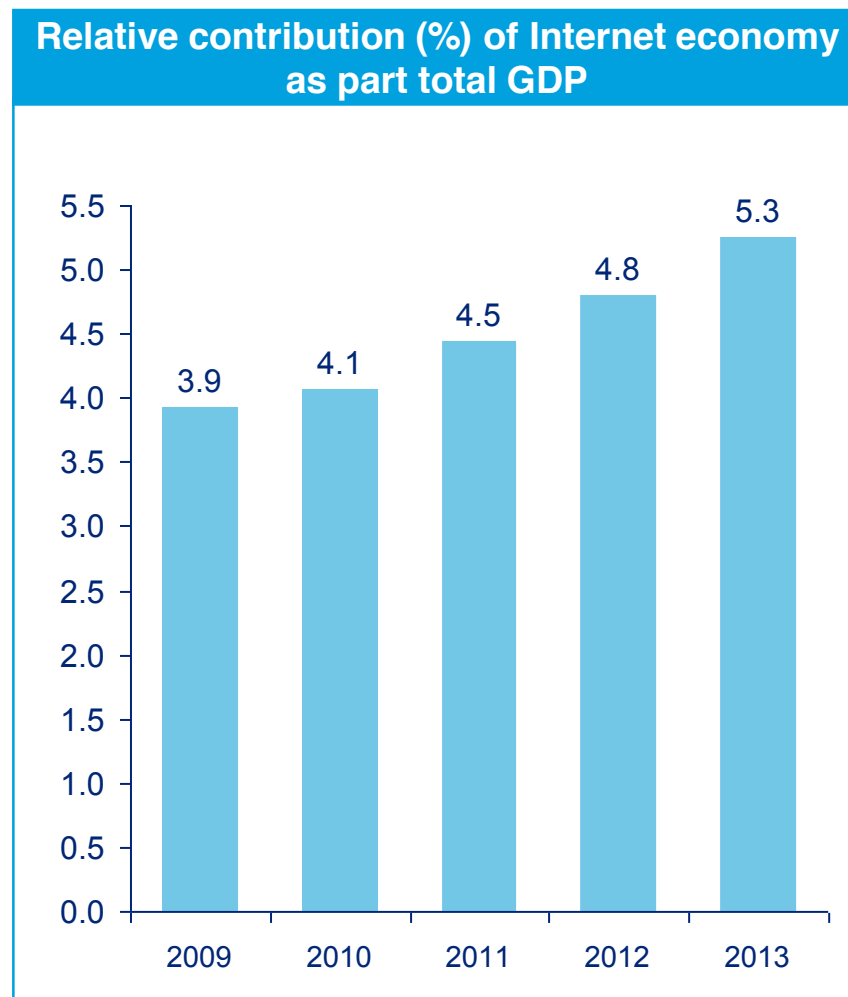
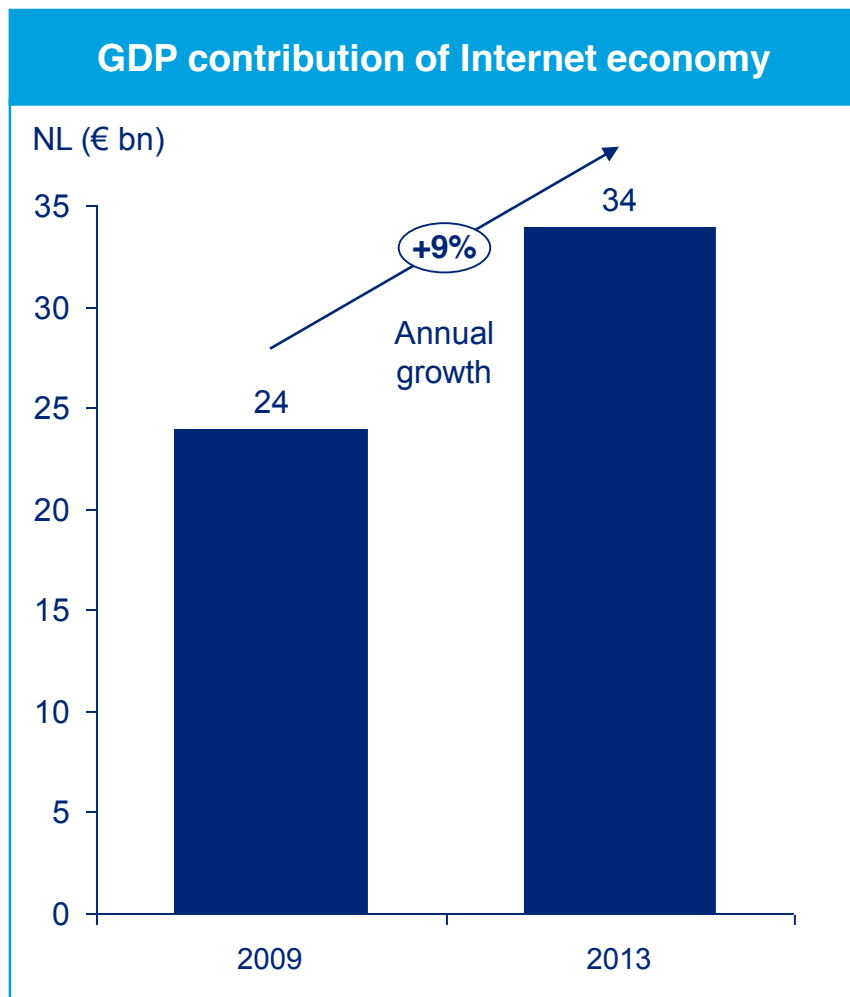
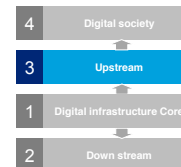


Digital Infrastructure is part of a much larger online ecosystem generating at least ~ €39 bn in revenue in the Dutch economy



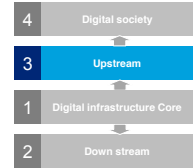
Sources: Ecommerce Europe Report; Gartner Public Cloud Report; Gartner IT Services Report, Deloitte analysis

Including private investments, government spending and trade, the Internet economy in NL adds an estimated €34 bn to the GDP which is approximately 5.3% of the total GDP and steadily growing

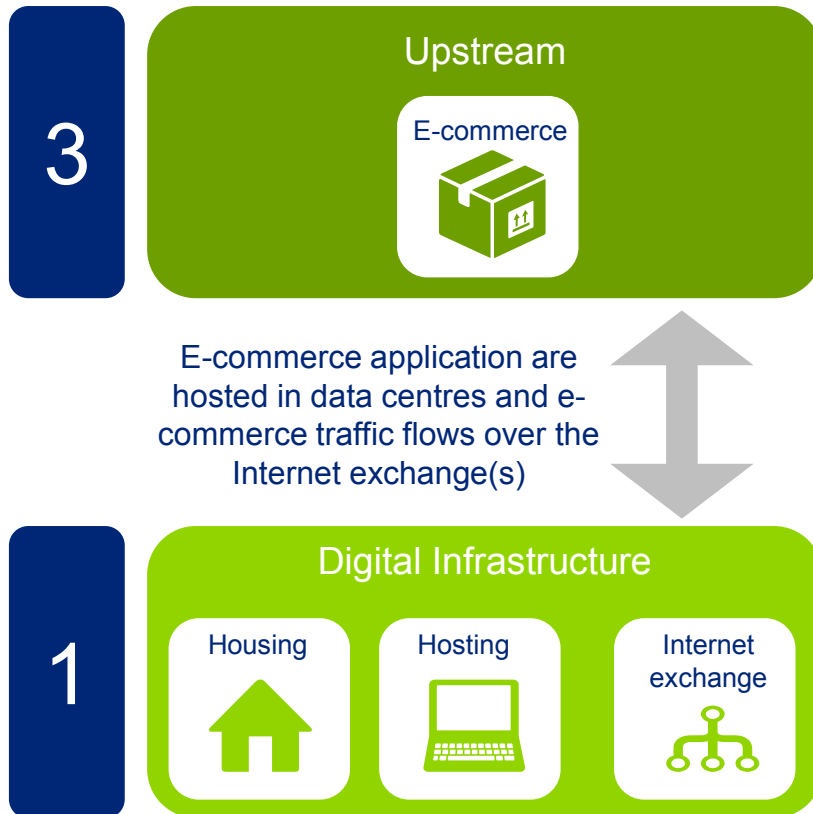


Sources: BCG NL Report; Eurostat Database; Gartner IT Services Report; Deloitte analysis

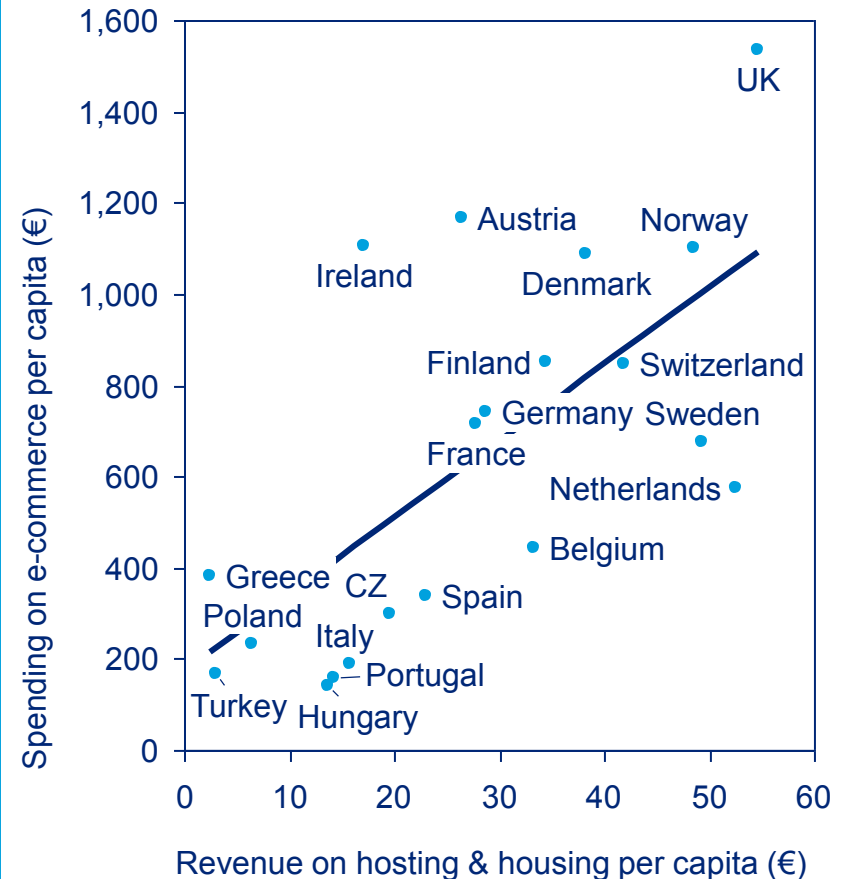
There is a strong correlation between the Digital Infrastructure and e-commerce which shows that the former is a key enabler



Strong correlation between Digital Infrastructure and e-commerce

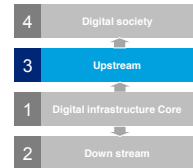


The correlation between hosting & housing revenue and spending on e-commerce per capita



Note: revenue on hosting & housing per capita is adjusted for purchasing power
Source: Eurostat Database; Ecommerce Europe Report

The employment generated by e-commerce in NL is estimated between 100,000 and 140,000

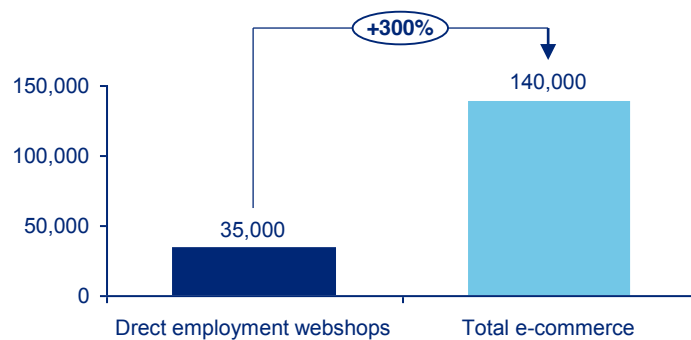


Estimating total employment based on e-commerce jobs ratio in UK

	UK		NL
E-commerce size	€107 bn	: 10	€10.6 bn
Jobs	930,000 – 1.1 mln	: 10	100,000 – 110,000

Sources: Ecommerce Europe Report; EMRG Report; Deloitte analysis

Estimating employment based on CBS data



*“75% of Internet impact arises from traditional industries”
(Mckinsey, 2011)*

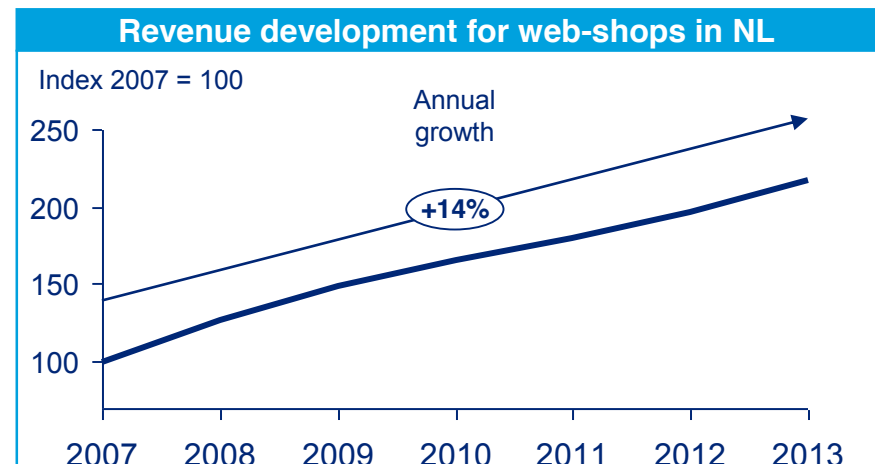
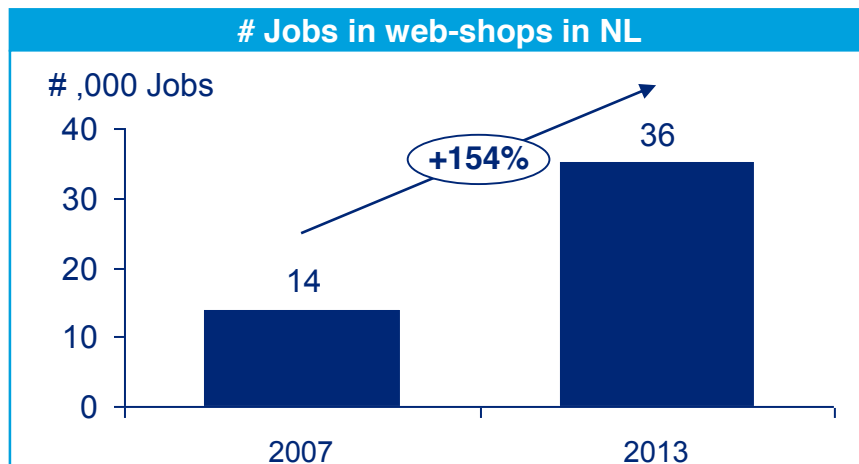
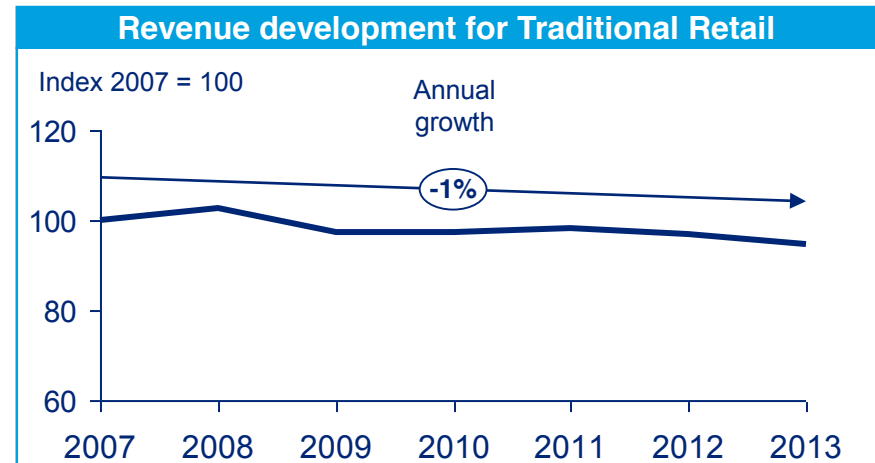
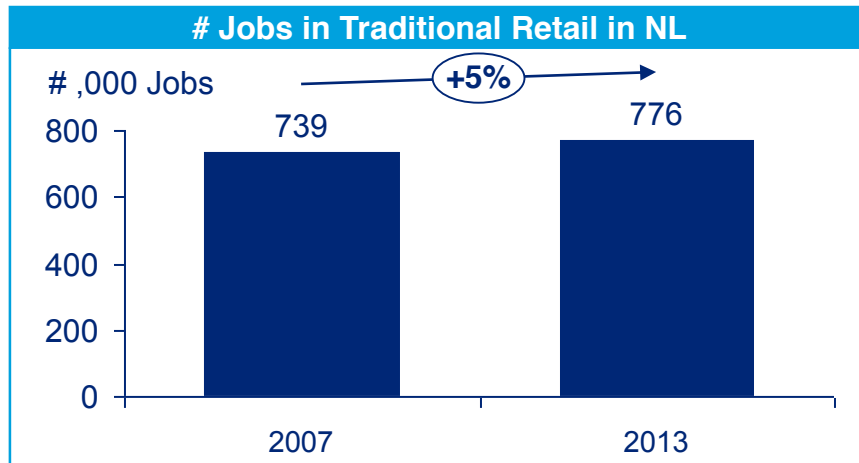
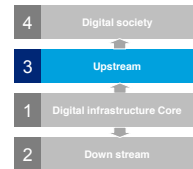
Source: ING Report; CBS Database; Mckinsey Report

Employment



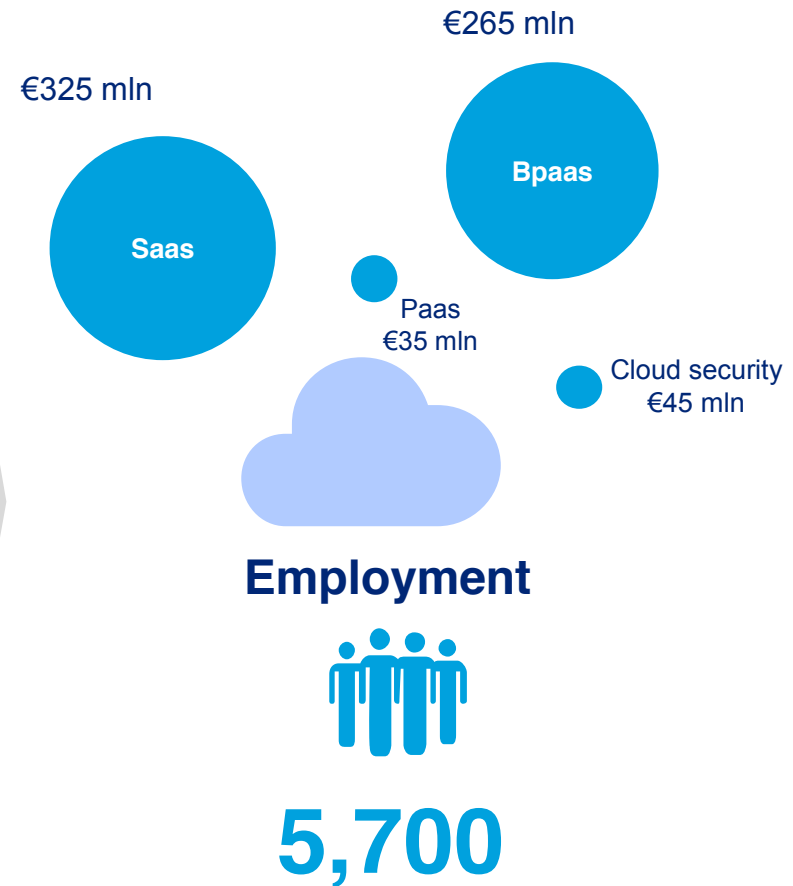
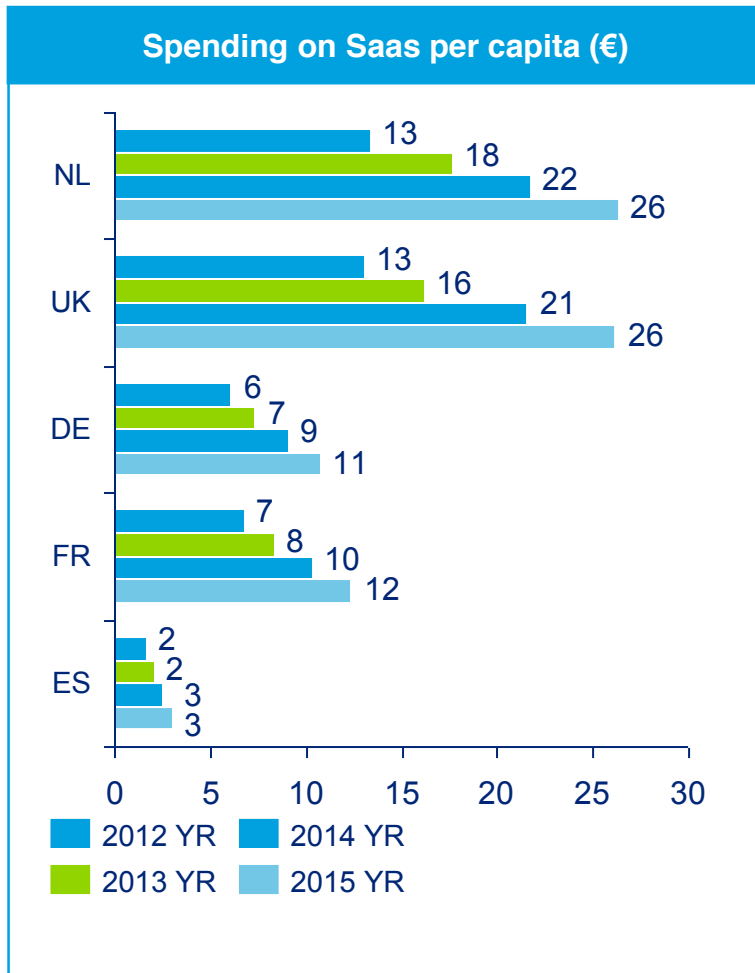
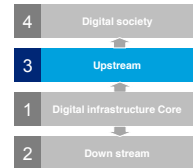
100,000 - 140,000

While Traditional Retail is almost flat in revenues and shows only a slight increase in employment, the revenues and employment in web-shops are strongly increasing



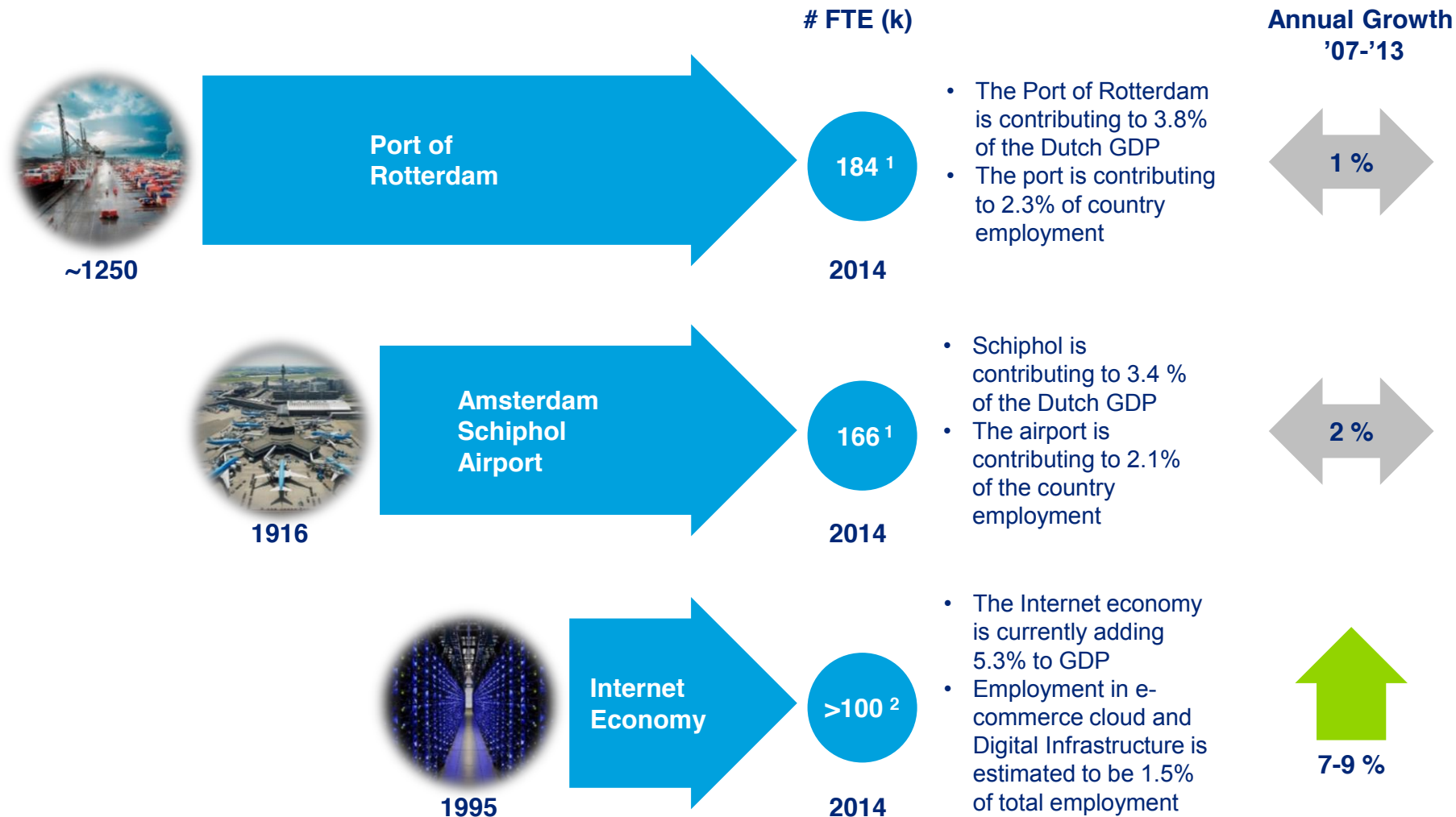
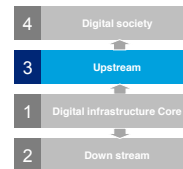
Sources: CBS Database; ING report

SaaS and PaaS are two of the Digital Infrastructure's closest relatives, generating 5,700 jobs in the Dutch economy



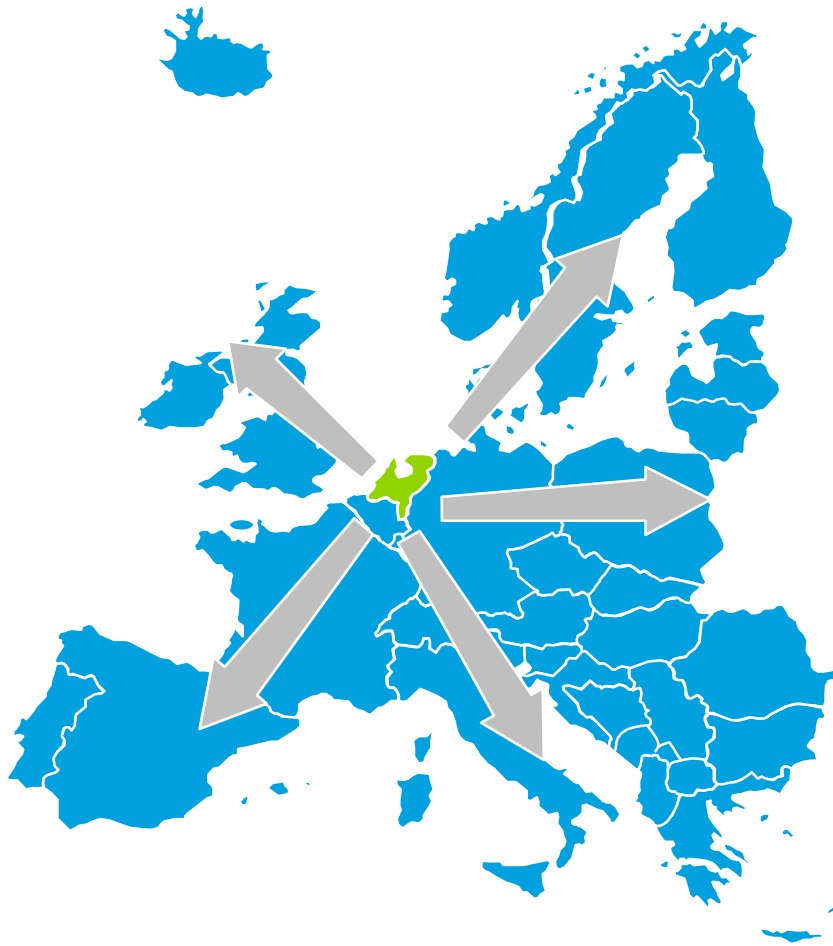
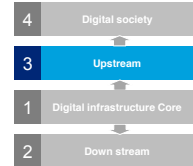
Sources: Gartner IT Spending Forecast Report; CBS Database; Deloitte analysis

Given its age, the Internet economy has already a large impact on the Dutch economy and is growing at a rapid pace relative to other growth enablers



1: Direct + Indirect FTE; 2: Direct FTE in E-commerce and cloud services
 Sources: RHV Erasmus University; Ecquants Report

In addition to the global market, the Digital Infrastructure is a key driver for global companies to locate in NL to serve the EU



“Our world-class Digital Infrastructure is an important driver for foreign IT companies to locate in the Netherlands and from there serve the European market and beyond.”

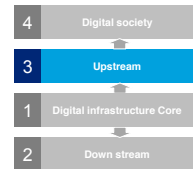
Henny Jacobs, director Investment Projects, NFIA
(Netherlands Foreign Investment Agency)

“GoGrid has chosen Amsterdam due to its good network connectivity, central location in Europe, and the proximity of companies looking for an IaaS provider.”

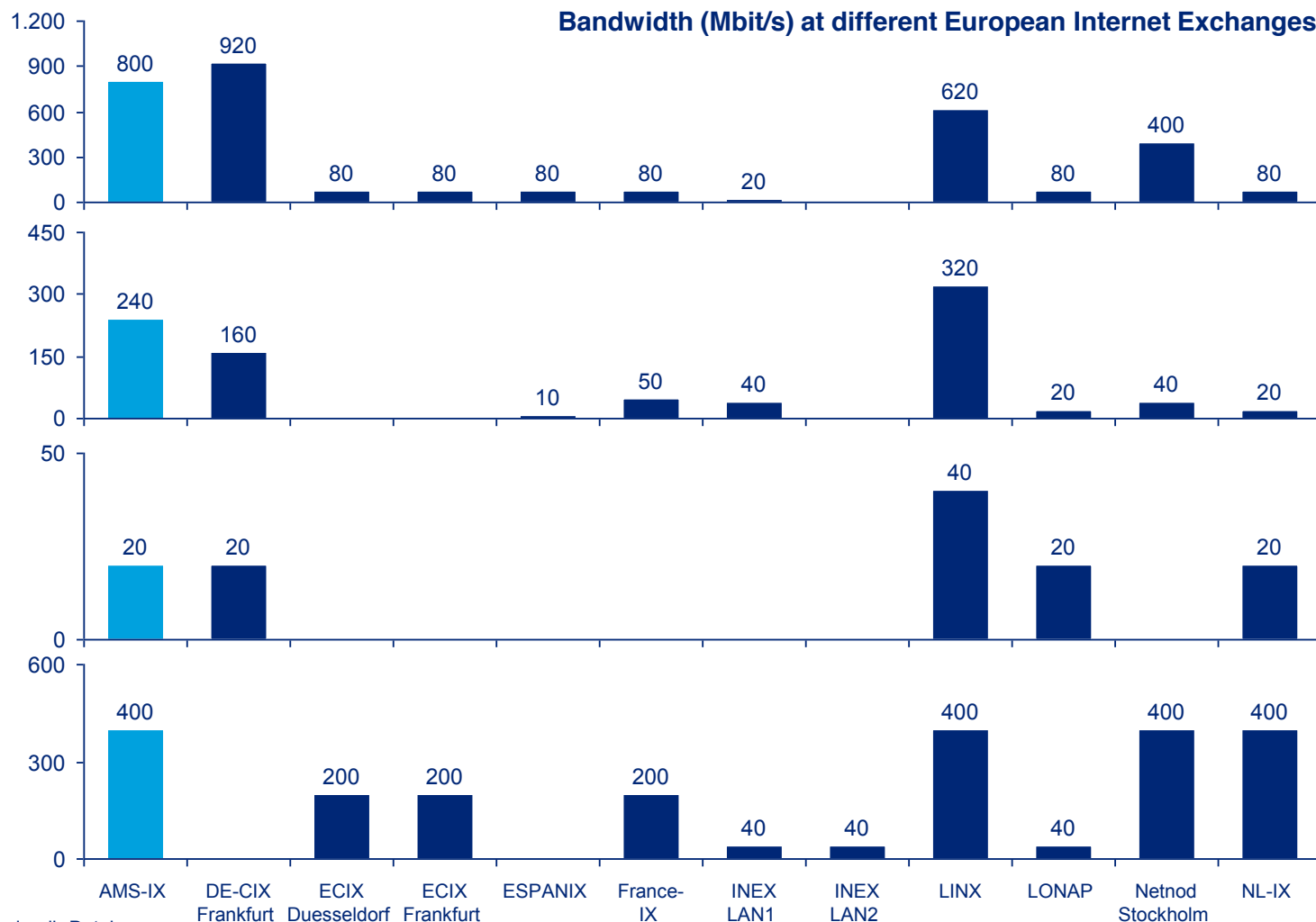
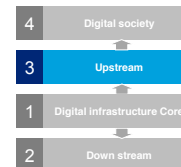
Bobby Brown, Vice President of Operations and Support at GoGrid

Source: Netherlands Foreign Investment Agency

As a result NL is hosting the top of the world's technology and Internet companies as gateway to Europe and the Internet

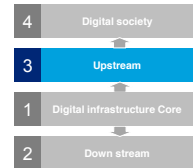


The world's largest service providers and e-commerce companies have chosen Amsterdam as their #1 or #2 Internet Exchange position in the EU

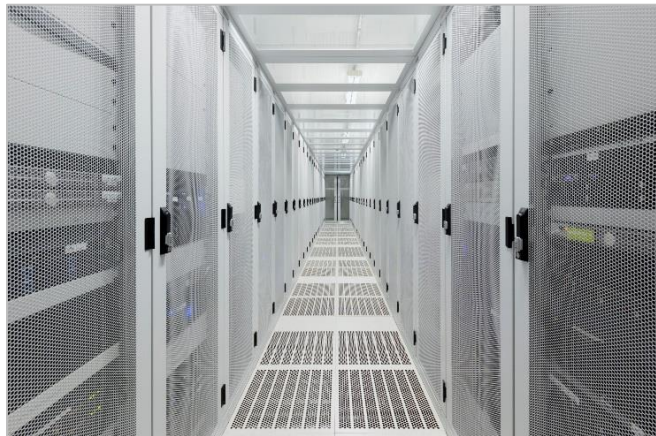


Sources: Euro-IX website; Peeringdb Database

Large investments in data centres within the Netherlands by corporate multinationals like Google and IBM generate additional employment



- Google invests **€600 million** on a data centre located in Delfzijl, the Netherlands.
- The estimated additional employment that the data centre will provide is **150 FTE** from operations and a **1000 FTE** at the peak of construction
- Planned year of the data centre to be operational is **2017**

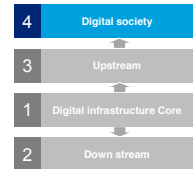


- In 2011 Softlayer, an IBM company, chose NL as its European headquarters
- It built a large data centre and invested over **€100 mln**
- Softlayer chose NL because of its fast connections to the rest of Europe

Sources: NFIA, NRC website; Parool website

D. Contribution to the digital society

Digital Infrastructure is a key enabler for the broader digital society, affecting the use of Internet, the broader economy and society



Disruptive technologies like cloud, that impact every sector's productivity, heavily depend on Digital Infrastructure

Economic impact



Internet is used for sales, purchases, marketing, with Dutch firms profiting from storage facilities and Internet exchange points close by

Business use of Internet



Dutch Digital Infrastructure forms the backbone to a society with the strongest social impact of Internet in the world

Social impact

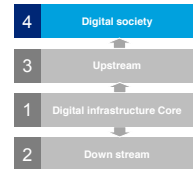


Digital Infrastructure in NL enables the Dutch to use super fast Internet, making it easy to communicate, consume media, bank etc.

Individual use of Internet



The Digital Infrastructure sector highly correlates with the use of Internet by businesses ...

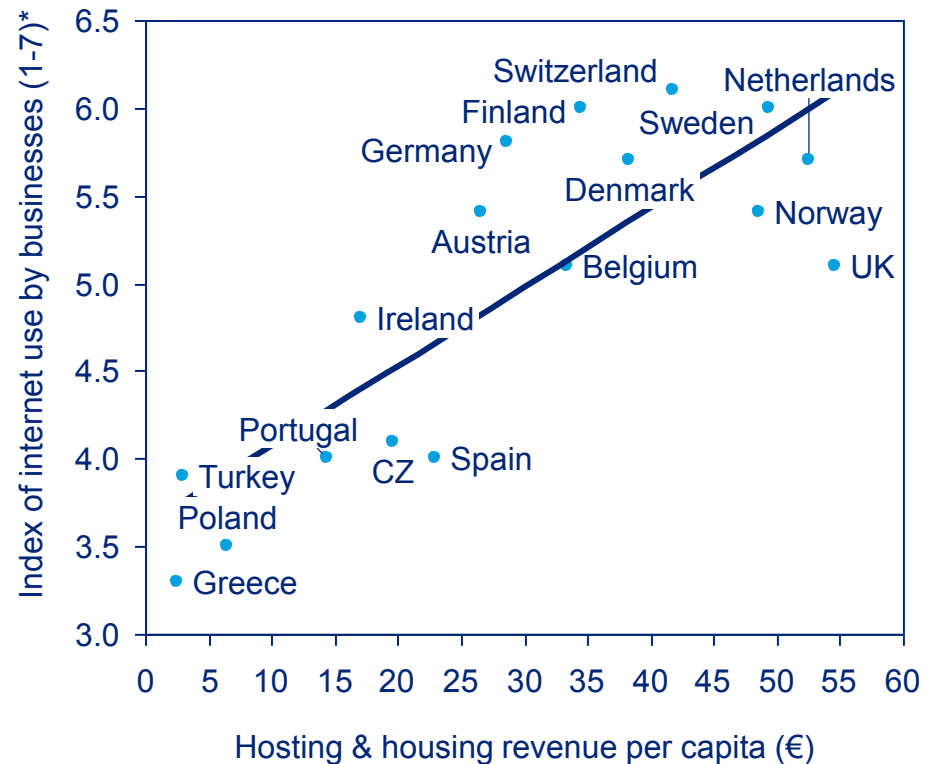


55% of the Dutch buy goods/services over the Internet at least ones per 3 months vice a vice an EU average of 38%



98% of Dutch businesses make use of the Internet vice a vice an OECD average of 94%

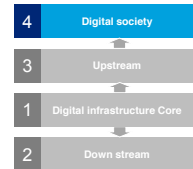
Digital Infrastructure highly correlates with business use



* Index of measures on Internet use by businesses, including B2B & B2C Internet use, firm capacity for innovation and tech absorption, extent of staff training, PTC patents applications (all measured on 1-7 scale)

Note: revenue on hosting & housing per capita is adjusted for purchasing power
Sources: Eurostat database; OECD Report; World Economic Forum, Insead, Cornell University Report

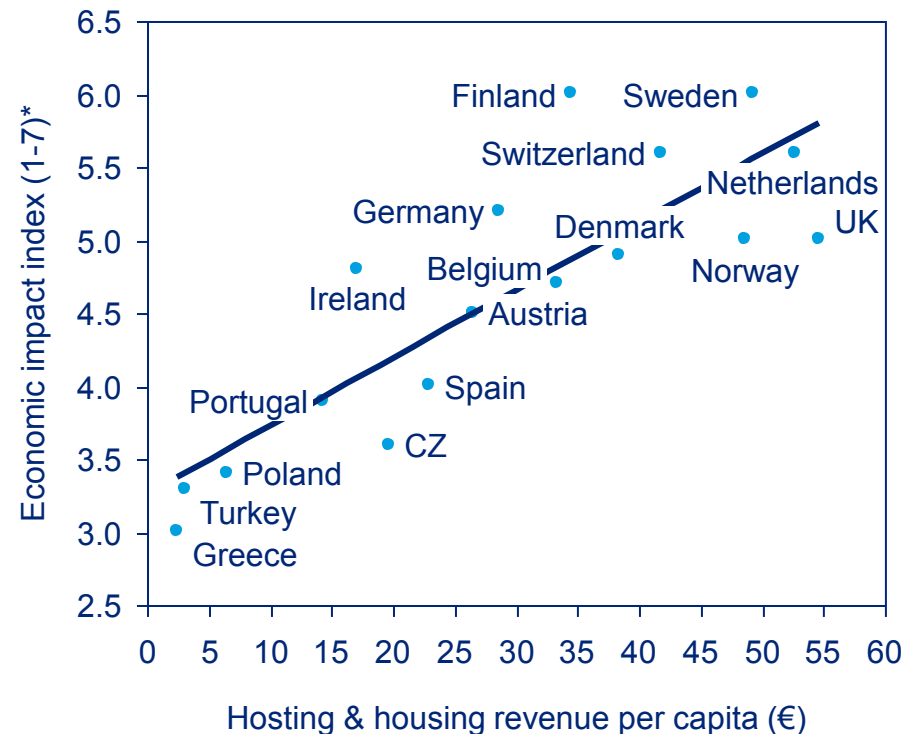
... and with economic impact through innovation and productivity gains



According to Etro (2009), fast adoption of innovative cloud services could have created as much as **10,800** new Dutch SMEs during the past 5 years in retail, wholesale, tourism, transports, communication, and real estate & business activities

“Displacing in-house IT, software and support, makes **5%** or greater additional time available for other tasks (...) with efficiency savings likely to spur training and redeployment rather than lay-offs” (LSE, 2012)

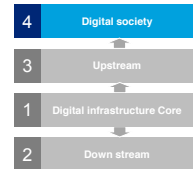
Digital Infrastructure highly correlates with economic impact of Internet through innovation and productivity gains



* Index consists of measures on impact of ICTs on new services & products, patents, organizational models (surveys, 1-7 scale), and knowledge intensive jobs as % of workforce

Note: revenue on hosting & housing per capita is adjusted for purchasing power
Sources: F. Etro (2009); LSE Report; World Economic Forum, Insead, Cornell University Report

Furthermore, the market size of the Digital Infrastructure sector is highly correlated with the use of Internet by individuals



93% of Dutch households have Internet access, ranking the Dutch number 1 in Europe

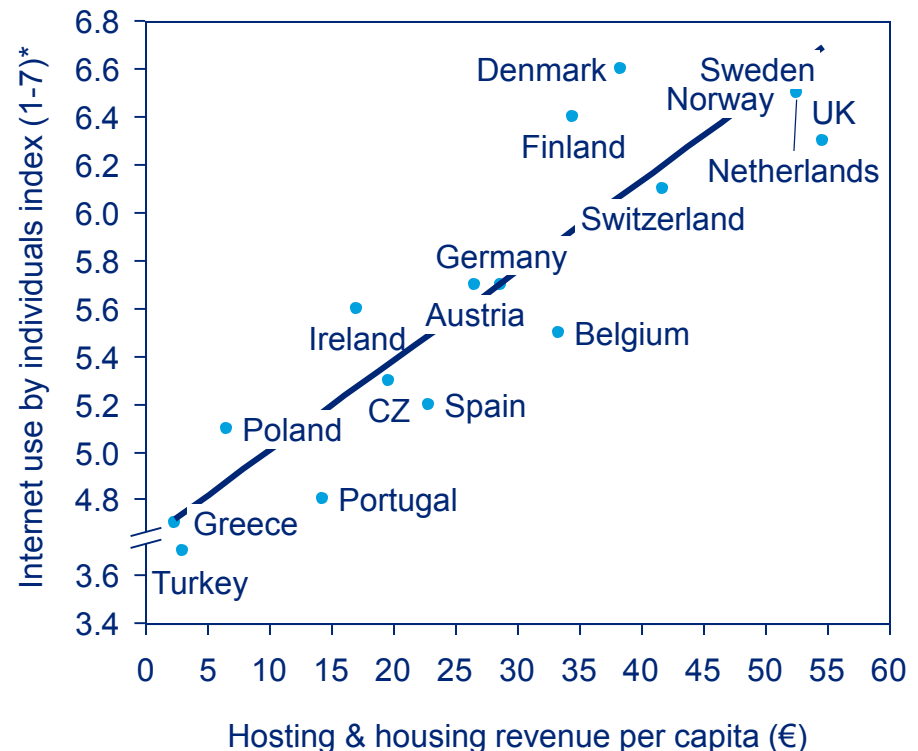


79% of the Dutch use Internet for banking, almost double that of the OECD average



88% of the Dutch use Internet to communicate

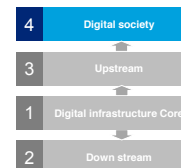
Digital Infrastructure highly correlates with Internet use by individuals



* Index consists of measures on individuals using Internet (%), households with a pc & Internet access (%), mobile phone & broadband subscriptions (100 pop), fixed broadband Internet subs (100 pop), use of social networks (1-7 scale)

Note: revenue on hosting & housing per capita is adjusted for purchasing power
Sources: OECD Report; World Economic Forum, Insead, Cornell University Report

... which in turn has a positive effect in the social impact of the Internet in a country

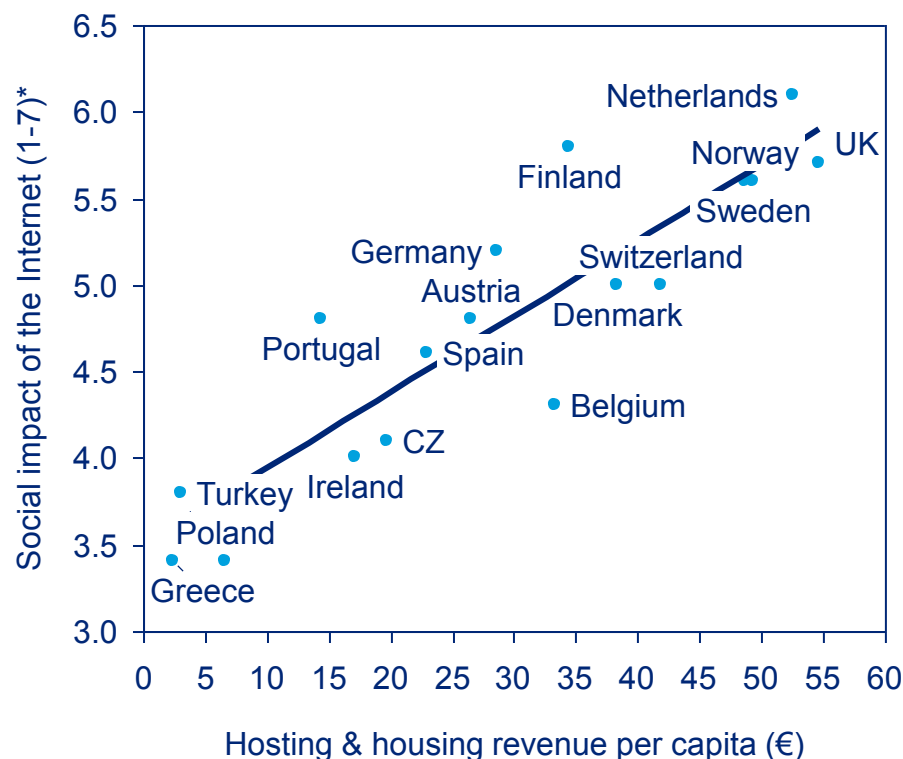


79% of the Dutch interact with e-government in the past year vice a vice an EU average of 41%



The Dutch rank number 1 in Internet access at schools, covering **100%**

Digital Infrastructure highly correlates with social impact of Internet



* Index consists of measures on impact of ICTs on access to basic services, Internet access in schools, ICT use & government efficiency (all measured on 1-7 scale), E-Participation index (0-1)

Note: revenue on hosting & housing per capita is adjusted for purchasing power
Sources: Eurostat Database, World Economic Forum, Insead, Cornell University Report



4. Future of the sector

- Conclusions
- Recommendations

The NL Digital Infrastructure sector is rapidly expanding, but employment in the sector itself, although growing, is limited

In Europe the Netherlands remains a frontrunner in the rapidly expanding Digital Infrastructure sector

- The Netherlands has a leading position in internet exchanges, datacenter housing and hosting, three sectors that together with telecommunications form the Digital Infrastructure
- Amsterdam based AMS-IX holds on to its position as the largest Internet exchange point in the world (in terms of number of peering networks). In the last 12 months, total Internet traffic increased by 30%
- NL scores 2nd place in EMEA and 5th globally on broadband penetration and average connection speed
- The Amsterdam region has cemented its position as a European hotspot for colocation with a year-on-year growth in supply of 6.3%
- NL holds a strong position in hosting services, ranking 2nd in revenue per capita and relative market size
- Cloud will become a key driver for growth in the Digital Infrastructure sector. In the next years, global data centre traffic is expected to show an increase of 25% a year, in which Cloud contributes with an annual growth rate of 35%

The impact of the sector itself on the Dutch economy is relatively small, though on a steep growth trajectory

- The NL Digital Infrastructure sector is capital intensive with an annual revenue of €1.18 billion and investments of €380 million
- Direct employment from operations in the sector adds up to 7,600 jobs
- An additional 11,700 jobs are created in sectors supplying inputs for production and construction, as well as workforce spending in the broader economy
- Employment in the sector grows on average 8% a year, translating in ~3,000 extra jobs within 5 years in the sector itself

However, the real impact of Digital Infrastructure lies in its growth enabling effects on the much larger digital economy and society

Digital Infrastructure is a driver for the Internet economy with much higher revenues and employment

- The NL Internet economy is estimated to be 5.3% of GDP and increasing 9% a year.
- Digital Infrastructure is an important enabler for direct employment in e-commerce and cloud services, providing jobs for at least 100,000 people
- While in theory a footloose Internet economy could blossom at distance from local Digital Infrastructure, our research shows that the size of the Internet economy is highly correlated with the size of the national Digital Infrastructure sector
- Our explanation for that is a mutual amplification of the following effects:
 - The online sector and the Digital Infrastructure sector both profit from the same root causes
 - Demand-effect: growth in the Internet economy increases demand for Digital Infrastructure
 - Supply-effect: the presence of strong Digital Infrastructure attracts suppliers of online products and services

Digital Infrastructure is a pre-condition for a strong digital economy and society

- Countries with a strong Digital Infrastructure sector tend to have more individuals and businesses using the Internet, with the Netherlands consistently ranking high on Digital Infrastructure and Internet use
- Countries with a strong Digital Infrastructure sector benefit more from the economic impact of the Internet through innovations and productivity gains

To benefit even more from its strong position in Digital Infrastructure and raise economic growth, we have the following six recommendations

1. **Support investments and developments in the Digital Infrastructure sector.** Barriers for investments and additional national or European legislation have a negative impact on economic growth as the sector is a driver for the international internet economy and the digital society
2. **Create incentive measures for the online ecosystem as a whole.** Do not only look at the core Digital Infrastructure sector, but also to the down- and upstream sectors as they strengthen each other
3. **In particular, stimulate innovations that depend on the Dutch Digital Infrastructure.** Chances for growth can be found in E-commerce, online services and by stimulating cloud innovations by Dutch firms
4. **Stimulate the choice of NL as a host nation for multinationals who offer digital services.** In the wake of stiff international competition and growing importance of Digital Infrastructure for business operations, attracting foreign firms who are heavy users of our digital facilities can contribute significantly to the growth of the Dutch online ecosystem
5. **Form regulatory frameworks which focuses on the broader picture.** The size and growth of the Digital Infrastructure and the Internet economy justifies its own frameworks, avoiding unnecessary legislation
6. **Align education to ensure a workforce that meets the needs of the digital economy.** The rate of change and growth of the digital economy and the impact on our society requires a proactive approach to teach digital skills in all aspects parts of the educational system



5. Appendices

- List of Sources
- List of Authors

List of sources

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